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NORTH AMERICAN FAUNA

No. 24

[Actual date of publication, November 23, 1904]

A BIOLOGICAL RECONNAISSANCE OF THE BASE OF THE ALASKA PENINSULA

BY

WILFRED H. OSGOOD
ASSISTANT, BIOLOGICAL SURVEY

Prepared under the direction of
DR. C. HART MERRIAM
CHIEF OF DIVISION OF BIOLOGICAL SURVEY

WASHINGTON
GOVERNMENT PRINTING OFFICE
1904

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Biological Survey,
Washington, D. C., August 15, 1904.

Sir: I have the honor to transmit herewith for publication, as North American Fauna No. 24, the results of a biological reconnaissance of the base of Alaska Peninsula by Wilfred H. Osgood, an assistant in the Biological Survey who visited this part of Alaska in 1902. It comprises observations made in the field and subsequent systematic studies, and is entirely the work of Mr. Osgood.

The illustrations, consisting of two maps and five half-tone plates, are necessary to a clear understanding of the text.

Respectfully,

C. Hart Merriam,
Chief Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

CONTENTS.

Page.
Introduction 9
General account 10
    Outline of route 10
    Iliamna Bay to Lake Clark 10
    Lake Clark to Nushagak 14
    Nushagak to Cold Bay 19
Life zones 21
Previous work 25
List of mammals 27
List of birds 51

ILLUSTRATIONS.

Page.
PLATE I. Sketch map of vicinity of base of the Alaska Peninsula....... Frontispiece.
II. Fig. 1.—Mountains near entrance to Iliamna Bay. Fig. 2.—Mountain meadow on west side of Iliamna Pass.......... 10
III. Fig. 1.—Lower end of Lake Clark. Fig. 2.—Mountains on Lake Clark, opposite mouth of Tleekakeela River. Fig. 3.—Keejik Mountain, near Keejik, Lake Clark.......... 12
IV. Fig. 1.—Mixed woods along Chulitna River. Fig. 2.—Semitundra along upper course of Chulitna River.......... 16
V. Fig. 1.—Upper part of Chulitna River. Fig. 2.—Chulitna River...
VI. Fig. 1.—Mountains near Cold Bay. Fig. 2.—Mountains near Kanatak. 20
VII. Map showing the life zones of the region.......... 24

No. 24. NORTH AMERICAN FAUNA. NOVEMBER, 1904.

A BIOLOGICAL RECONNAISSANCE OF THE BASE OF THE ALASKA PENINSULA.

By Wilfred H. Osgood.

INTRODUCTION.

The present report contains an account of a hasty trip made during the latter part of the summer and fall of 1902 to the base of the Alaska Peninsula. Work was done on both coasts and in part of the interior. On account of the importance of the region as a meeting ground of some of the life areas of Alaska, it was desired that more time be spent in the field, but the shortness of the season prevented. Since it is not feasible at present to continue work in this region, it has been decided to record such results as were obtained.

Throughout the trip Alfred G. Maddren acted as my assistant and Walter Fleming was employed as camp hand. During the season of 1903 Mr. Maddren spent considerable time in the Cold Bay and Becharof Lake region. Although for the most part occupied otherwise, he secured a considerable number of specimens, as well as some important notes for which I am indebted to him. M. W. Gorman, of Portland, Oreg., who was engaged in botanical work for the Department, accompanied us during July on Lakes Iliamna and Clark, and his cheerful cooperation was greatly appreciated.

Travel was chiefly by canoe. On account of the inclement weather, which prevailed most of the time, progress was slower than if the party had been able to start before the fall rains began. Natives were employed from time to time as carriers and guides, and as a rule proved faithful and efficient. The employees of the Trans-Alaska Company, which had some stores in the region, rendered considerable assistance, and we were particularly indebted to H. Hicks and C. T. Brooks. Much of the region has seldom been visited by white men, and such of the streams and lakes as were shown on published maps were indicated on little more basis than hearsay or the unreliable sketches of natives and prospectors. The accompanying map, made from rough sketches and estimates, is doubtless incorrect to a great degree, but will show the points to which it is necessary to make special reference. Until actual surveys are made in the region, it may prove helpful to future travelers.

GENERAL ACCOUNT.

OUTLINE OF ROUTE.

Landing at Iliamna Bay (Pl. I, Frontispiece) on July 10, the party immediately proceeded across the mountains to Lake Iliamna and thence to Lake Clark, where a few days were spent. On August 10 the journey up the Chulitna River was begun. Some short delays were caused by the uncertainty of the native guides as to the correct route, but on the 18th of the month the head of the small south fork of the river was reached. Crossing from there to Swan Lake and starting down stream August 27, the Swan, Kakhtul, and Nushagak rivers were successively descended and Nushagak reached September 12. After considerable delay a small sailboat was secured to take us across Bristol Bay, and on September 26 we started for Igagik. Thence the Ugaguk River was ascended and Becharof Lake crossed to the head of its southwest arm, which was reached October 7. Continuing from here over the mountains to Kanatak, on Portage Bay, we skirted the coast to Cold Bay, which was reached October 13. A small steamer called on the 26th of the month and we took passage for the United States, very glad to flee from the exceedingly stormy weather which had prevailed during the last two months of the trip.

For convenience of description the route outlined above may be divided into three parts: (1) Iliamna Bay to Lake Clark, including the Lake Iliamna and Lake Clark region; (2) Lake Clark to Nushagak, including the Chulitna River region and the Nushagak drainage from Swan Lake to Nushagak; and (3) Nushagak to Cold Bay, including the peninsula region in the vicinity of the Ugaguk River and Becharof Lake.

ILIAMNA BAY TO LAKE CLARK.

The coast of Iliamna Bay, like nearly all the southeast side of the Alaska Peninsula, is extremely mountainous. The mouth of the bay is wide, but the upper end, for 4 or 5 miles, is quite narrow. Even in summer it is a very windy place. When we landed, on July 10, a howling gale was blowing down the funnel formed by the mountains on each side, and we reached shore with considerable difficulty. The mountains are from 3,000 to 6,000 feet in altitude, and are quite precipitous (Pl. II, fig. 1). They support no trees worthy of the name, but there are several groves of fair-sized balsam poplars (*Populus balsamifera*) in the narrow valley at the head of the bay and also on some low

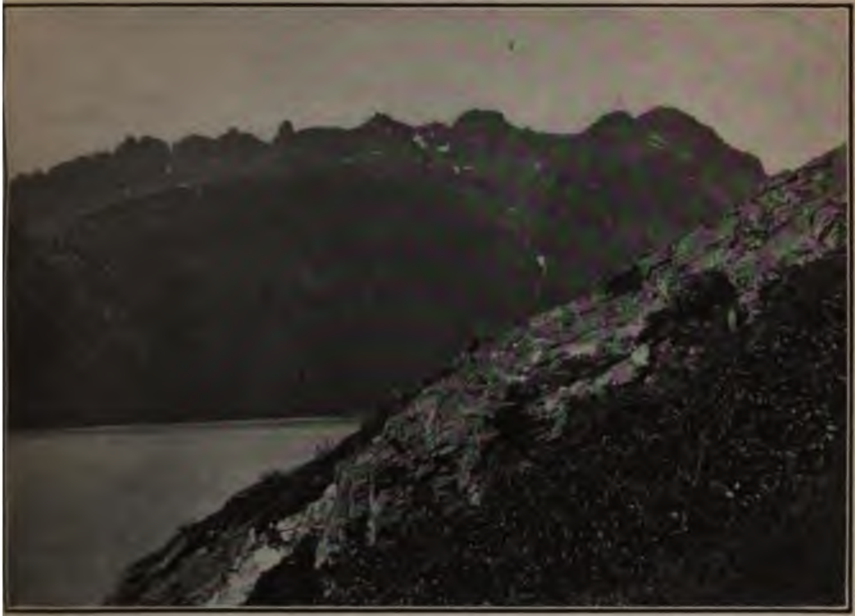

FIG. 1.—MOUNTAINS NEAR ENTRANCE TO ILIAMNA BAY.
Plant in foreground dwarf birch (*Betula glandulosa rotundifolia*).

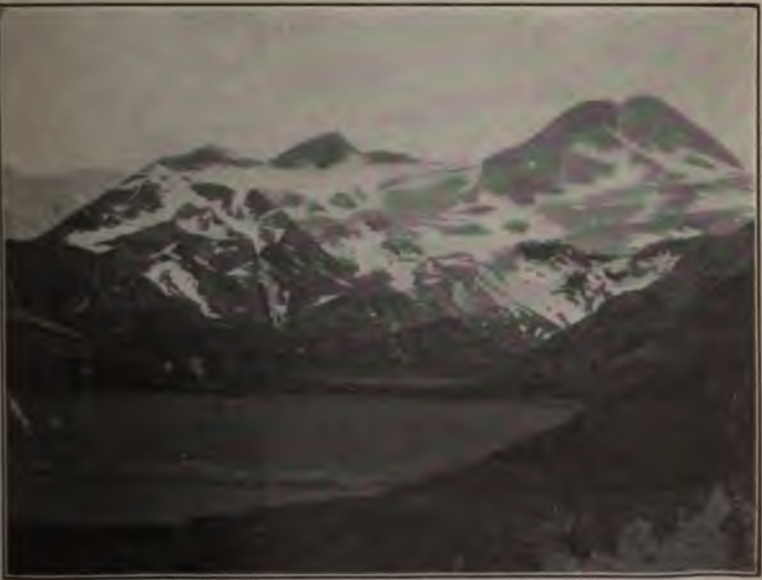

FIG. 2.—MOUNTAIN MEADOW ON WEST SIDE OF ILIAMNA PASS.
Shrubby plant, alder (*Alnus viridis*).

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
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Washington, D. C., August 15, 1904.

SIR: I have the honor to transmit herewith for publication, as North American Fauna No. 24, the results of a biological reconnaissance of the base of Alaska Peninsula by Wilfred H. Osgood, an assistant in the Biological Survey who visited this part of Alaska in 1902. It comprises observations made in the field and subsequent systematic studies, and is entirely the work of Mr. Osgood.

The illustrations, consisting of two maps and five half-tone plates, are necessary to a clear understanding of the text.

Respectfully,

C. HART MERRIAM,
Chief Biological Survey.

Hon. JAMES WILSON,
Secretary of Agriculture.

of the Nogheling River. The carry begins a few miles east of the mouth of the Nogheling and crosses the triangular peninsula to the river above the falls. The first half of the trail is over rather swampy open country and the last through open forest on comparatively hard ground. Above the portage there is one stretch of a third of a mile of swift water, easily descended by canoes but difficult of ascent except at low water when 'tracking' is practicable; otherwise the river is ascended without great difficulty although the current is strong. The entire length of the Nogheling is from 25 to 30 miles. In the vicinity of the portage it flows in one general direction between banks from 50 to 75 feet high, but toward its upper end it traverses lower country and its course is more devious. Near Lake Clark it expands in two places, the larger being about a mile wide by 3 miles long. Low mountains, somewhat sparingly covered with small spruce timber, rise on both sides of the river, those on the west being higher and reaching an approximate altitude of 1,500 feet.

Our first view of Lake Clark from the low ground near the head of the Nogheling River was not an impressive one, as we were so situated that only the lower end (Pl. III, fig. 1), where the shores are comparatively low, could be seen. When once on the lake itself, however, with an unobstructed vista of the greater part of its length, the view was magnificent. The mountains, which are from 500 to 1,000 feet in height at the lower end, extend along each side of the narrow stretch of water, and gradually become higher and higher and more and more rugged (Pl. III, fig. 2). In reality the peaks are not very high, but their gradual increase from the lower end of the lake to the upper, with the misleading vista effect, causes them to appear quite lofty. The higher peaks immediately surrounding the head of the lake are possibly of an altitude of 5,000 feet; others, farther back, which may be seen at a distance, are somewhat higher.

All the mountains on the south side of the lake and most of the others also are of eruptive origin and evidently date from no very remote geological period. Those about the upper end are steep and but slightly eroded, being too precipitous in most places to hold large snow banks. On the south side near the upper end, however, several small, high-hanging glaciers may be seen at the head of narrow canyons. On the north side for about 5 miles at the upper end, the mountains are slates, which are possibly exposures of similar formations known to occur to the northward in the main part of the Alaskan Range. At the lower end of the lake and also on the north side of the Nogheling River are several terraced beach benches, the apparent evidence of former occupation by salt water at receding levels. Much of the valleys of the Chulitna and Nushagak rivers is of a recent sedimentary character, doubtless once part of an old lake or inland *arm of the sea.* The whole region is only a little above the present

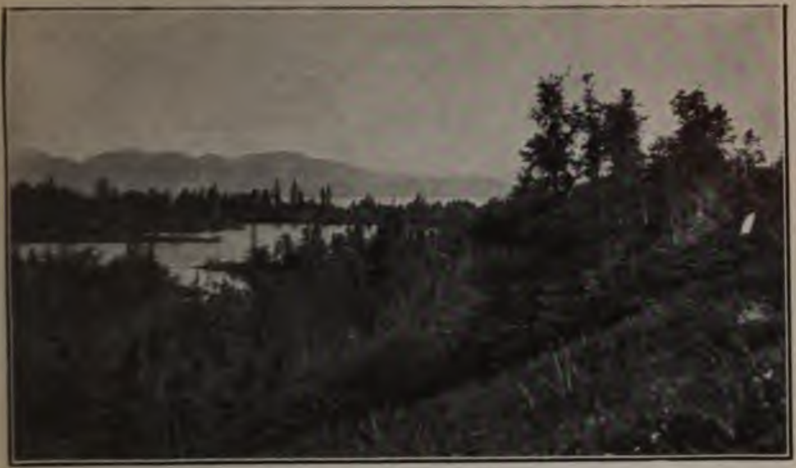

FIG. 1.—LOWER END OF LAKE CLARK.

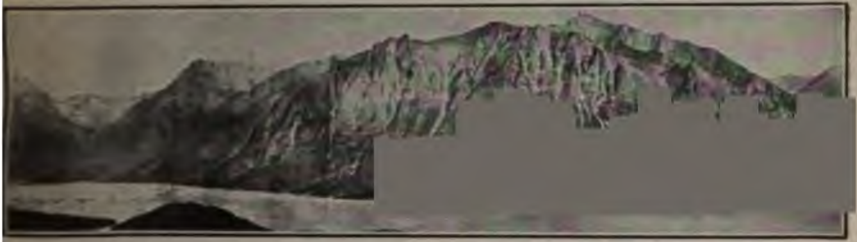

FIG. 2.—MOUNTAIN ON LAKE CLARK OPPOSITE MOUTH OF TLEEKAKEELA RIVER.

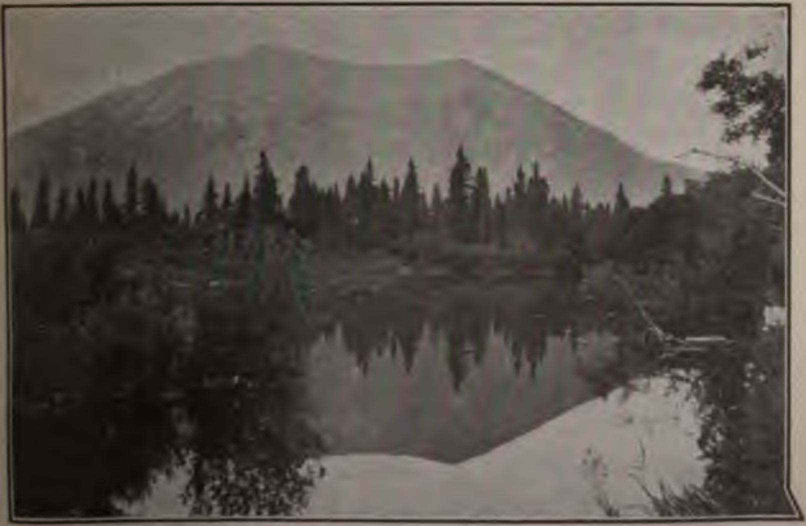

FIG. 3.—KEEJIK MOUNTAIN, NEAR KEEJIK, LAKE CLARK.

ILLUSTRATIONS.

Page.
PLATE I. Sketch map of vicinity of base of the Alaska Peninsula....... Frontispiece.
II. Fig. 1. Mountains near entrance to Iliamna Bay. Fig. 2. Mountain meadow on west side of Iliamna Pass 10
III. Fig. 1. Lower end of Lake Clark. Fig. 2. Mountains on Lake Clark, opposite mouth of Tlekakeela River. Fig. 3. Keejik Mountain, near Keejik, Lake Clark 12
IV. Fig. 1. Mixed woods along Chulitna River. Fig. 2. Semitundra along upper course of Chulitna River 16
V. Fig. 1. Upper part of Chulitna River. Fig. 2. Chulitna River ...
VI. Fig. 1. Mountains near Cold Bay. Fig. 2. Mountains near Kanatak. 20
VII. Map showing the life zones of the region........................ 24

of poplars (*Populus balsamifera*), many individual trees slightly exceeding 12 inches in diameter. A beautiful open forest of birch and spruce is found in some localities, and much of the ground in such places produces tall grass (*Agrostis*) in great abundance. Devil's club (*Echinopanax*) occurs in a few dark, sheltered places near the head of the lake, and perhaps reaches the northwestern limit of its range there. Willows and alders abound in their respective relative positions, while smaller shrubs and boreal plants are in characteristic profusion.

LAKE CLARK TO NUSHAGAK.

The route now most frequently traveled between Lake Clark and Nushagak is by way of the Nogheling River to Lake Iliamna, and thence by the Kvichak River to Bristol Bay and around the coast or across country from Koggiung to Nushagak. Our route, which is more practicable for summer travel, was by the Chulitna River, across to the Nushagak drainage, and on down to the coast. This route was formerly used to a considerable extent when the region was inhabited by many more natives than at present. Now it is well known to the older natives only, and signs of travel along it are few and obscured by time.

The Chulitna is the largest stream emptying into Lake Clark. It enters on the northwest side, about 15 miles above the outlet of the lake. Its waters are of the dark amber color, characteristic of northern streams which drain tundra and semitundra areas; and its mouth, where the current is scarcely evident, might be mistaken for an arm of the lake, but for the sudden change in the color of the water. Looking upstream from the mouth of the river, the country appears comparatively level, as far as can be seen. On the right are a few low hills, spurs from the higher range along the lake; on the left also are scattered hills, outliers of the ridges which extend down the northwest side of the Nogheling River and Lake Iliamna. For several miles above the mouth of the river the country is low and swampy. At one place there are several channels traversing a wide, grassy swamp, the habitat of various waterfowl. Several days were spent here, while a fresh supply of provisions was brought up from a cache made on the Nogheling River. On August 10 we were ready to start up the Chulitna. Up to this time the weather had been comparatively mild and bright, with only an occasional squall. Now, however, there began a continuous rain, which for days and days did not abate for more than several hours at a time. Progress upstream, slow enough at best, was rendered more so by the disagreeable weather.

Owing to the low, swampy nature of the country near the mouth of the river, the timber consists chiefly of scrubby growths of black spruce, with clumps of birches and poplars on the occasional higher and drier spots. Some 8 or 10 miles up, however, the land, though still low and comparatively level, becomes drier, and the banks of the stream are better defined. Alders and willows line the banks, and 40 or 50 feet back of them is nearly continuous forest of white and black spruce mixed with birch and aspen (Pl. IV, fig. 1). Occasionally the stream divides into several channels, and here the current is usually swift. A day and a half took us through most of the bad water, for, strangely, the swiftest part of the river is in its lower courses. On the third day there was less swift water, and good progress was made. Small areas of open mossy tundra were passed (Pl. IV, fig. 2). In the few places where the banks expose it, this mossy mat is seen to be from one to two feet in thickness, with gravels or clays beneath, apparent evidence that the region was once part of a lake or sea basin. Occasional small hills are seen, some with slight exposures of lava-like rock, but nearly all blanketed with moss. At intervals are thick clumps of white spruces, many of which are at least 50 feet high and about 1½ feet in diameter. Another day through similar country brought us to Neekahweena Lake, which is a very beautiful little piece of water of an extent of 10 or 15 square miles. From the middle of the lake small detached mountains and hills can be seen in various directions and at considerable distances. One of these, an elongate, apparently flat topped mountain, lying to the southwest, our native guide pointed out to us as his landmark, calling it the 'Portage Mountain.'

Nearly all the region about this lake is low and swampy. For 5 or 6 miles up the river the course is between dense thickets of alders and willows. Tall grass (*Agrostis*) grows very luxuriantly along the edges of the banks and well back into the thickets, being universally distributed except where tundra conditions prevail. For some 15 miles above the lake, the stream, which is very devious throughout, becomes particularly tortuous and winds and turns in a continuous series of convolutions. The 'Portage Mountain' alternated on all sides of us, and a small conical hill which in the morning appeared about half a mile ahead was not passed until late in the afternoon. Particularly fine clumps of white spruce were encountered along this part of the route; several trees were measured and found to be from 5 to 6 feet in circumference. Others noticed in passing were evidently somewhat larger than these. Four or 5 miles farther on the river suddenly narrows down to a uniform width of 40 to 60 feet (Pl. V, fig. 1), and flows canal like, with a steady, even current, against which we were able to row with ease our heavily loaded canoe. The banks are covered with characteristic tundra vegetation nearly to the water's edge, but a thin line of spruce timber still persists near the border of the stream.

The mouth of the south branch of the river was reached after five days of travel from Lake Clark. With a light canoe and good weather the trip might be made in three or three and a half days. The so-called South Fork of the river is much smaller than the main stream, and averages only about 15 feet in width. It is of nearly uniform depth, however, without shallow bars—a typical tundra stream. It was from 3 to 6 feet deep when we ascended, but several days later, when we last saw it, the continued rains had caused a rise of water of about 3 feet. It is bordered on each side by a thin line of spruce timber, behind which is practically open tundra with many small scattered ponds.

An entire day was occupied in ascending the south branch for about 9 miles to a big bend which lies about northwest of the 'Portage Mountain.' In many places the stream was so narrow that the canoe could barely be eased around the turns, and in others large trees had fallen across, blocking the way, so that the axe was in use almost as much as the paddles. Camp was made at the bend, and after several days' search Swan Lake was found and a portage route selected. During this time a trip was made to the top of the 'Portage Mountain,' from which an extensive view of the country was obtained. The mountain is about 1,400 feet above sea level and stands somewhat alone, being connected only by a low ridge with the mountains about the head of the Kakhtul River. From the summit one views to the eastward the broad, comparatively level region drained by the Chulitna, and to the westward a similar region along the Swan River. To the southward the course of the Kakhtul is easily followed from its source in the bare-looking mountains between it and Lake Iliamna to the vicinity of its junction with the Swan. From this elevated viewpoint one fully appreciates how closely the heavier growth of coniferous trees is confined to the banks of the streams. Although the water itself is only occasionally seen, both the Chulitna and the Kakhtul can be traced as far as the eye can distinguish by the lines of dark green spruce along their banks. The Swan is less easily followed on account of the small lakes which comprise most of its upper course. The whole region, in fact, presents a panorama of small lakes. It is reasonably safe to state that a thousand bodies of water of varying size and conformation can be seen from a single point on the top of the 'Portage Mountain.'

The land is largely swampy and is covered with typical tundra vegetation. Beneath the tundra throughout the region are waterworn rocks and coarse gravels, and along some of the hills are well-marked terraces of former lake or sea shore. The lakes or ponds are usually sunken a few feet below the general level. Around their banks is a somewhat better growth of dwarf birch and willow than elsewhere. In the occasional areas of higher and drier ground and on the low slopes and detached mound-like hills about the base of the mountain there is considerable spruce, which in protected 'draws' on the south

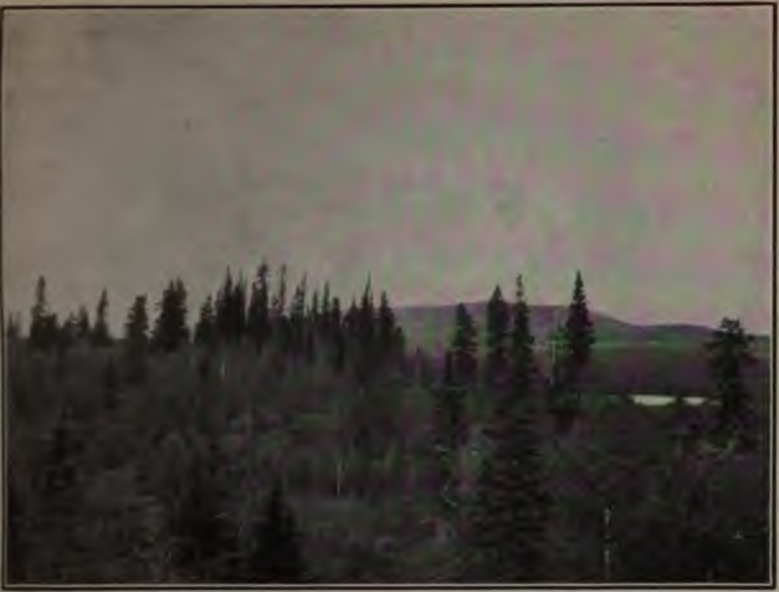

FIG. 1.—MIXED WOODS ALONG CHULITNA RIVER.

Trees: *Picea canadensis*, *Populus tremuloides*, *Betula papyrifera*.

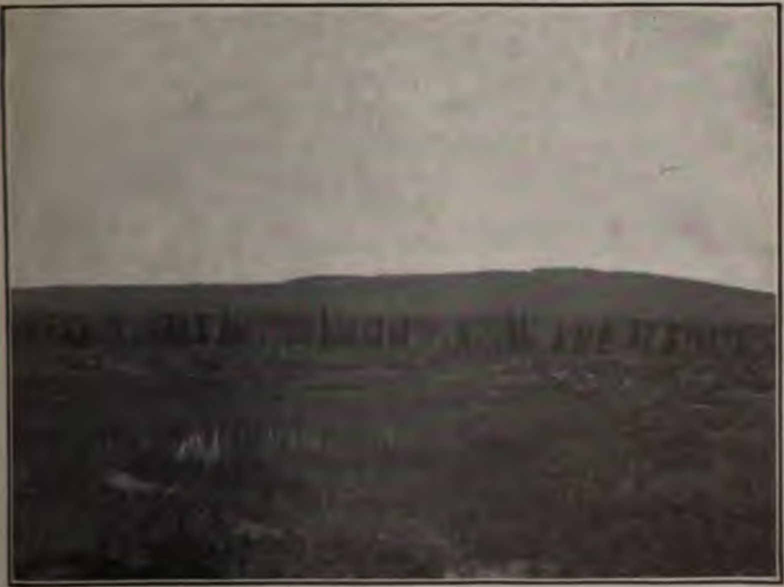

FIG. 2.—SEMITUNDRA ALONG UPPER COURSE OF CHULITNA RIVER.

Trees in middle distance *Picea mariana*.

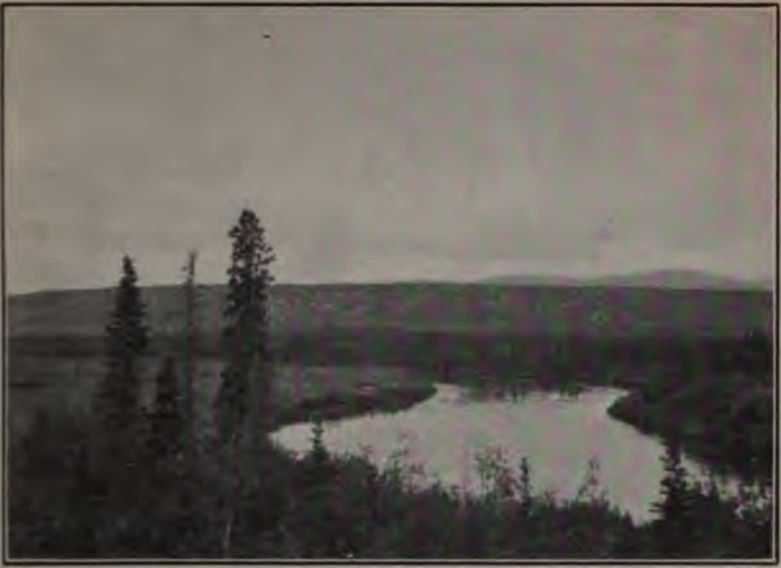

FIG. 1.—UPPER PART CHULITNA RIVER.

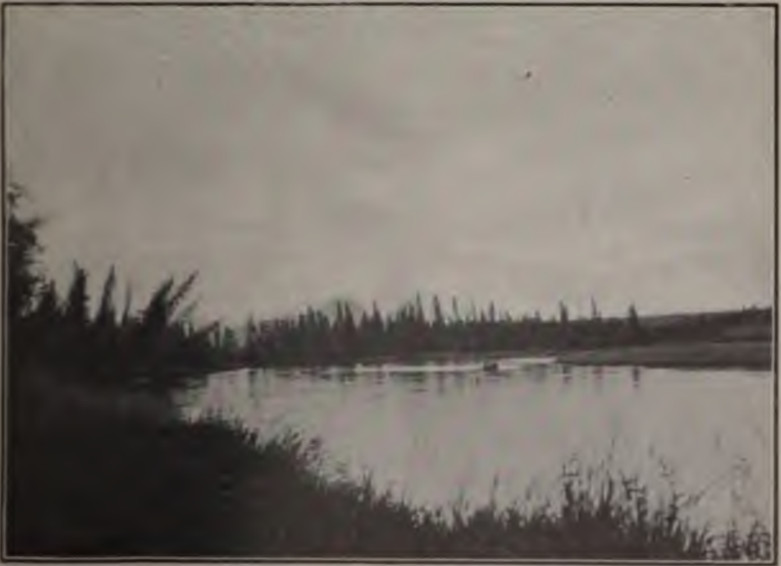

FIG. 2.—CHULITNA RIVER.

Picea canadensis being undermined by current.

ide ascends to an altitude of perhaps 700 feet. A few cold streams ourse down the mountain, their narrow gulches crowded thickly with lders and the ground beneath luxuriantly clothed with grass. The pen mountain sides, except in the rockier parts, are blanketed with reindeer moss and semi-procumbent shrubs, chiefly *Vaccinium*, *Arctos*, *Chamæcistus*, and *Salix*. Among the foothills poplars (*Populus tremloides* and *P. balsamifera*) and birches (*Betula papyrifera alaskana*) are fairly common.

The route selected for the carry from the camp on the Chulitna to Swan Lake covered a distance of about 5 miles, half of it being over wet, boggy tundra and the remainder over comparatively hard ground. The divide between the drainages is scarcely more than 50 feet high. Swan Lake is clear and cold, and is about three-fourths of a mile long by one-third as wide; its depth is not more than 2 or 3 feet, except in a few holes. The bottom is diatomaceous ooze.

Leaving Swan Lake on August 27, we passed successively through ix similar lakes and the short streams connecting them. The first ten hours of travel were disagreeable, as the shallow and tortuous streams made it necessary to wade and drag the heavily loaded canoe over a long series of gravel bars. Below the lakes the water of the Swan becomes deeper and flows in one general direction to the Kakhtul. It s a rather sluggish stream, however, as the much larger and swifter Kakhtul apparently backs up the water to some extent. At the junction of the Swan and Kakhtul we left temporarily the level country nd passed between low ranges of hills, the one on the right being mmediately adjacent to the river and that on the left lying about two miles distant and parallel. Near the mouth of the Kakhtul, that is, ts junction with the Malchatna River, we camped for several days, being favored with definitely clear weather for the first time since leaving Lake Clark. The hills on each side of the Kakhtul are very imilar to the 'Portage Mountain' near Swan Lake. Spruce timber of fair size is found along the immediate banks of the river and for onsiderable distances on the small tributaries, but the intervening country is open tundra. From the tops of the low hills on the right side of the river the view extends across to the valley of the Malchatna, which is much like that of the Kakhtul, but wider. To the southward toward Nushagak the view is unobstructed. As far as the eye can see, the country appears to be low and nearly level. Somewhat to the westward one lone but conspicuous hill of peculiar contour rises out of this low country. This is the so-called Tikchik Mountain, a well-known landmark for the natives and other travelers in the region.

Breaking camp on the Kakhtul September 3, we soon entered the flat country where the river, now considerably larger, begins to divide its channel as it passes around many small wooded islands. The current is swift and the banks show many evidences of rapid dissolution and change. Early on the morning of September 4 the mouth of the Tikchik River was reached, and some much-needed provisions obtained at the cabin where remnants of the supplies of the defunct Trans-Alaska Company were for sale. Below the Tikchik the volume of water is much increased. Although there are many islands and long sand bars, the water seems to be of a depth sufficient for a small, light-draft steamboat, if carefully piloted, to navigate the stream. Although the country is for the most part low, the banks of the river, particularly on the northwest side, are frequently from 50 to 100 feet high. At the village of Kakwok about 25 natives were found, and nearly as many more were seen going upstream on hunting trips. They were in a very destitute condition, and many were much enfeebled or diseased. Ikwok, a small collection of igloos and caches a few miles above Kakwok, was found deserted, but with evidences of recent occupation, probably only temporary, by Kakwok natives. These were the only native habitations seen on the river. About 10 miles below Kakwok we began to observe indications of tidal influence, which, as we proceeded, rapidly became more marked. The lower part of the river is not peculiar. Along the banks considerable spruce timber is found all the way to Nushagak, though for the last 20 miles it is rather small and scattered. Within 30 miles of Nushagak, however, there are many good-sized clumps of white spruce, the trees averaging about 10 inches in diameter. Similar timber is said to be found along Wood River somewhat nearer to Nushagak. Birch and poplar are in great abundance, as well as alders and other characteristic Hudsonian shrubs, wherever conditions meet their various individual preferences.

The estuary of the Nushagak River is a wide bay traversed by swift tidal currents. At low water broad mud flats and long bars are exposed, particularly on the east side. Although good-sized vessels are able to enter the bay, navigation is difficult. A sandy bluff about 50 feet high begins a short distance above Nushagak and extends along the bay nearly to Point Etolin. Behind this bluff is a rolling country of the same general level, largely tundra, but with here and there clumps of small spruces. On the opposite shore of the bay considerable timber is seen scattered over low benches and irregular hills. In the distance appears a range of sharp-peaked mountains running about north and south, evidently the feeder of the Wood, Snake, and Igushik rivers. Late in September this range was covered with snow. Nushagak, or Fort Alexander, as it was formerly called, is the oldest of some eight or nine settlements which are clustered about various salmon canneries on the bay. From July to September, while fishing is in progress, it is a populous place; but during the remainder of the year it is practically a closed port, inhabited only by a half dozen watchmen and traders, with the usual parasitic settlement of natives. It was formerly one of the best fur-trading stations in Alaska, and, indeed, still is, as the business can hardly be said to have decreased there more than elsewhere.

NUSHAGAK TO COLD BAY.

When Nushagak was reached, September 12, all the larger fishing boats were found beached and housed in for the winter. No suitable sailboats were to be had for the trip across Bristol Bay, and we finally decided upon the hazardous undertaking of coasting around to Koggiung in our own canoe. By great good fortune, however, a small schooner, which had been reported lost, suddenly appeared, and passage was engaged to Igagik. Start was made on September 26, and the next evening Igagik was reached. Here a salmon cannery is situated just inside the mouth of Ugaguk River and surrounded by a half dozen rude dwelling houses for the watchmen and a small collection of igloos or native huts. The region is low and treeless.

The Ugaguk River offered no great difficulties, as it is only a little more than 40 miles in length, and all but the upper 5 miles is affected by the tide. Starting at 6.30 a. m. on September 29, and stopping a half-hour for luncheon, we were still able to make camp only one mile below Becharof Lake at 2 p. m. of the same day. The lower part of the Ugaguk at flood tide has the appearance of any ordinary tidal slew. It begins to look more like a stream about 10 miles above its mouth, where there are a few low bluffs, which, however, are not continuous. The river is wide and contains many shallow stretches, where long sandbars are doubtless exposed at ebb tide. The banks are lined with low, scrubby willows, with now and then a clump of small alders on an occasional higher and more protected bank. Often the banks are mere swamps only 6 inches or a foot above high-water mark. The stream cuts through a ledge of granite just as it issues from Becharof Lake. For about three-quarters of a mile the current is very swift, and many granite bowlders project above the water. This stretch of swift water is called the Ugaguk Rapids. Several days were spent at the foot of the rapids, as high winds caused a strong surf to break along the beaches at the lower end of Becharof Lake, making it impossible to put off in a canoe. The country around the lower end of the lake is very desolate. A stretch nearly a mile in width immediately bordering the shore consists of sandy, wind-swept dunes almost devoid of vegetation except for thin irregular mats here and there on protected slopes. Farther back plant growth is more continuous, but very depauperate. The chief woody plants are *Empetrum* and several small species of *Salix*.

On October 4, during a temporary lull of the wind, the canoe was lined up the rapids and the journey continued around the end of the lake to the south shore. After a long day of rowing, camp was made in a little bay near the northeast base of the volcano called by the natives Smoky Mountain. The lake is bordered by an almost continuous gravel beach, back of which are bluff-like hills clothed with tundra vegetation. Small willows are excessively abundant, and reindeer moss, Labrador tea, and crowberry are in great profusion. The alders at this time had shed their leaves, and at a short distance the scattered patches had the appearance of burnt ground. The willow leaves were turning yellowish, and some of the smaller plants reddish, and the whole effect was attractive. Continuing on the second day around the base of the mountain, we passed several stretches of high bluffs and rounded two or three rocky points and made camp on a narrow peninsula on the west side of the mouth of the long southern arm of the lake. On the following day, having threaded the small islands of the south arm, we continued on to the head of the arm and up a stream about one mile to a small subcircular lake at the base of the coast mountains. The course up Becharof Lake was along the south shore, and at no time was it more than a half mile from the beach. Along this route the water is seldom more than 15 feet in depth. It is very clear and cold, and the bowlder-strewn bottom is easily visible all the way. The region about the head of the arm is rather swampy and is characterized by a luxuriant growth of grass (*Agrostis*), which in many cases reaches to a man's shoulders. A small collection of native igloos or barabaras is located near the mouth of the stream. There is another on the little lake where we camped and made ready for the portage across the mountains. These mountains form an irregular semicircle about the small lake. They are from 2,000 to 3,000 feet in height, and are rough and rocky except for the first 500 feet, where the rolling slopes are more or less covered with grass and dwarf shrubs.

The portage trail runs from the east side of the small lake across a half mile of swamp, and thence up about 1,000 feet, traversing a rocky pass and continuing on down over more rocks to the native village of Kanatak, situated just above high-water mark on the bay of the same name. This bay is frequently called Portage Bay, which seems ill-advised on account of the existence of a better known Portage Bay farther west on the same coast. Two days of hard work in stormy weather sufficed to transport impedimenta to Kanatak. A small rowboat was immediately loaded, and we coasted around the rocky shore of Shelikof Strait to Cold Bay, as this was the only hope of securing passage on the southbound mail steamer. Cold Bay was reached on October 13 after a hard passage and a very narrow escape in a sudden storm off Cape Kanatak. Here we waited until October 26, when the steamer arrived, being hospitably entertained meanwhile by

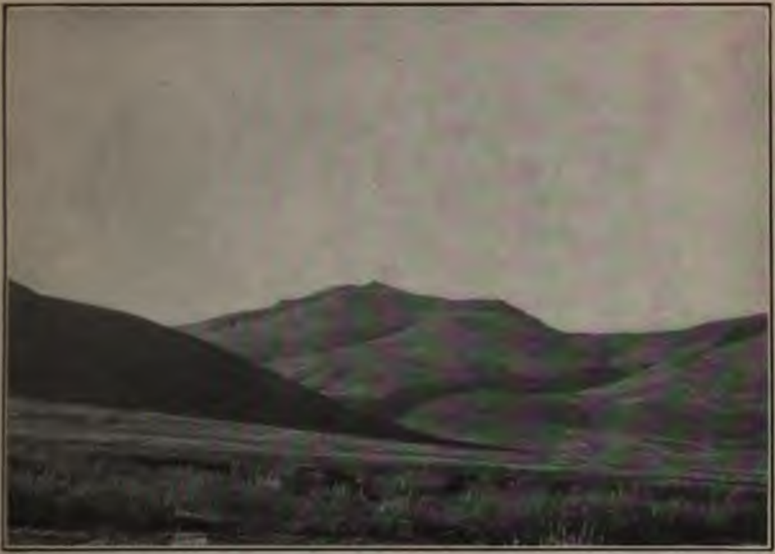

FIG. 1.—MOUNTAINS NEAR COLD BAY.

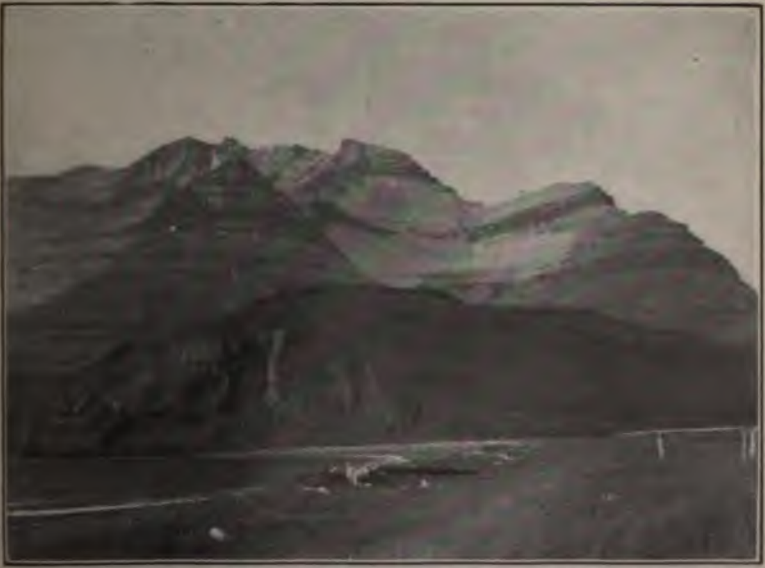

FIG. 2.—MOUNTAINS NEAR KANATAK.

Mr. J. H. Lee, who had charge of a small camp engaged in locating petroleum lands. Cold Bay is surrounded by bleak-looking mountains, in many places steep and bare, exposing sandstones and conglomerates (Pl. VI, fig. 1). A scanty growth of alder and willow is found along some of the streams, which are short, swift, and shallow. At the head of the bay there is a small area of level ground of a swampy nature. The hillside blanket of tundra vegetation is very thin, and the gravel or shingle beneath shows through in many places. Several low passes exist near Cold Bay, from which one looks down over a gently undulating descent to Becharof Lake, beyond which looms the snowy cap of the Smoky Mountain.

LIFE ZONES.

Practically all the region under consideration in the present paper lies along the border of the Hudsonian and Arctic zones. By using the actual limits of coniferous trees as a guide, the Arctic and Hudsonian may be sharply defined. The Arctic occupies the main part of the Alaska Peninsula southwest of the vicinity of Naknek Lake, together with a narrow strip northward along the coast of Bristol Bay and Bering Sea;[a] the Hudsonian, stretches over the region to the northward on the mainland. Throughout most of the part which may be assigned to the Hudsonian there are frequent occurrences of apparent Arctic intrusions in so-called faunal islands. Tundra conditions, in more or less insular form, occur throughout the Hudsonian zone, and in this border country are merely more numerous and extensive than farther south. By tundra is meant absolutely treeless country, where vegetation forms a thick mat consisting largely of mosses, lichens, saxifrages, dwarf willows, and such small plants as *Empetrum*, *Ledum*, *Andromeda*, *Chamæcistus*, *Vaccinium*, *Arctos*, and *Dryas*. Throughout the Hudsonian of this region such tundra is found in patches varying in size from a few acres to several square miles. About the upper end of Lake Iliamna, which may be regarded as a timbered region, there is considerable tundra, and the lower end of Lake Clark presents similar conditions. The valley of the Chulitna River, though containing much timber, some of it of fair size, is largely a tundra region, except along the immediate border of the stream and its more important affluents. Along the Nushagak drainage the subordination of the forest is still more pronounced, and the coniferous trees are strung out in thin lines confined to the very banks of the water courses. The accompanying map (Pl. VII), intended to indicate the limits of the coniferous forest, obviously fails, in the nature of the case, to show this mixture of forest and tundra, and presents only a somewhat generalized boundary along the front of the region in which timber grows.[a]

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[a] The extension of the Arctic zone to Bristol Bay was recognized by Nelson in 1887, when an 'Alaskan-Arctic' was defined to include the 'treeless coast belt.' (See Natural History Collections in Alaska, U. S. War Dept., pp. 27–32, 1887.)

The Arctic and Hudsonian faunas appear to coincide reasonably well with the limits of the treeless and timbered regions. This delimitation of the coniferous trees, therefore, may fairly be used to mark the boundary between the Arctic and Hudsonian zones. Of the mammals found in the treeless region about Bristol Bay and the base of the Alaska Peninsula, the most characteristic Arctic species are the pied lemming (*Dicrostonyx*), the Arctic hare (*Lepus othus*), and the Arctic fox (*Vulpes lagopus* subsp.). Besides these, the following marine Arctic mammals which occur along the coast should be mentioned: *Delphinapterus*, *Balæna*, *Erignathus*, and *Odobenus*. Among Arctic birds known to breed as far south as Nushagak are: *Stercorarius parasiticus*, *Polysticta stelleri*, *Somateria v-nigra*, *S. spectabilis*, *Charadrius d. fulvus*, *Squatarola squatarola*, *Crymophilus fulicarius*, *Lagopus lagopus*, *Acanthis h. exilipes*, *A. l. holbœlli*, *Calcarius l. alascensis*, *Passerina nivalis*, and *Budytes f. alascensis*.

The Hudsonian division of the region of the base of the peninsula has in general the same fauna found throughout this zone in Alaska. Practically the entire fauna reaches to the very edge of the zone—that is, to the limit of coniferous trees. Some genera, and doubtless also some species, extend into the Arctic for considerable distances or throughout. Among these genera are *Citellus*, *Evotomys*, *Microtus*, *Rangifer*, *Gulo*, *Lutra*, *Putorius*, and *Sorex*. Such forms are very wide-ranging, for, as has been stated in a previous paper,[b] the fauna of the Hudsonian zone in Alaska is not characterized by peculiar forms, but consists largely of genera, and in many cases of species, which continue on from the Canadian. Those common to the Arctic and Hudsonian, therefore, also occur in the Canadian and are common to all three. Among Hudsonian genera of mammals which do not enter the Arctic in this region are *Sciurus*, *Synaptomys*, *Mustela*, and *Ursus* (subgenus *Euarctos*).

The distribution of the races of native people in this region shows an interesting agreement with that of the plants and lower animals. The true Eskimos extend down the coast of Bering Sea to the vicinity of Nushagak, and are represented on the peninsula by the Aleuts, who are generally regarded as modified Eskimos. The Indians of undoubted derivation from pure Athabascan stock occupy the greater part of the region here assigned to the Hudsonian. At present Eskimos, Aleuts, and Indians are much mixed in the vicinity of the base of the peninsula. Under more primitive conditions the Eskimo tribes undoubtedly occupied the Arctic zone almost exclusively, while the Indians remained in the timbered Hudsonian region.[a]

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[a] For information as to forest conditions in various parts of the region not visited by our party in 1902, I am indebted to L. L. Bales, of Seattle, Wash., and to A. G. Maddren.

[b] *North American Fauna*, No. 21, p. 59, 1901.

"The boundaries of the several zones rarely coincide with absolute mechanical barriers, being fixed in the main by temperature."[b] In the case of the Hudsonian and the Arctic, the line between the timbered and the treeless regions offers a sharp boundary which, with regard to the respective faunas, seems to be effective to a considerable degree. So far as the region immediately adjacent on either side of this boundary is concerned, it seems probable that temperature is not so effective in restricting the faunas as the local environment. That is, the animals peculiar to the treeless Arctic and those characteristic of the timbered Hudsonian, while doubtless restricted to their general ranges by temperature, are confined in the vicinity of the boundary, respectively, to the Arctic because it is treeless, and to the Hudsonian because it is timbered, rather than as the result of any appreciable difference in temperature on either side of the dividing line. Along the boundary line between two zones where there are no important controlling factors except temperature, there is usually a belt in which occurs an overlapping of animal forms. This overlapping between the Hudsonian and Arctic zones is minimized by the difference in external conditions other than temperature. For the general areas of the two zones, temperature is of course the chief controlling factor. Points on the Yukon River in the heart of the Alaska Hudsonian, for example, are known to be decidedly different from points in the Arctic like St. Michael, both in respect to the hottest part of the year and to the total quantity of effective heat. Although there are no records in confirmation, it hardly seems possible that there is a corresponding or even an appreciable difference of this sort between the timbered Hudsonian around Lake Clark, for example, and the treeless Arctic region around Becharof Lake.[c]

The coniferous trees themselves are doubtless in the same manner restricted in their general range by temperature, but along their extreme limits other factors must have considerable effect upon them. This is particularly true in the Alaska Peninsula region where the limit is a southern rather than a northern one. Just what are all the causes determining the nonexistence of coniferous trees on the greater

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[a] See Nelson, The Eskimo About Bering Strait, 18th Ann. Rept. Bur. Am. Ethnology, p. 23, 1900, in which it is stated that "the western Eskimo described in the present work is found mainly within the limits of the area which I have designated elsewhere as the Alaskan-Arctic district."

[b] Merriam, Laws of Temperature Control of the Geographic Distribution of Terrestrial Animals and Plants. < Nat. Geog. Mag., VI, p. 230, 1894.

[c] St. Michael and Holy Cross Mission, for which there are some temperature records, occupy nearly the same relative positions, one being on the treeless coast and the other just within the timber limits. The difference in their effective temperatures is practically nil.

side ascends to an altitude of perhaps 700 feet. A few cold streams course down the mountain, their narrow gulches crowded thickly with alders and the ground beneath luxuriantly clothed with grass. The open mountain sides, except in the rockier parts, are blanketed with reindeer moss and semiprocumbent shrubs, chiefly *Vaccinium*, *Arctous*, *Ch[illegible]*, and *Salix*. Among the foothills poplars (*Populus tremuloides* and *P. balsamifera*) and birches (*Betula papyrifera alaskana*) are fairly common.

The route selected for the carry from the camp on the Chulitna to Swan Lake covered a distance of about 5 miles, half of it being over wet, boggy tundra and the remainder over comparatively hard ground. The divide between the drainages is scarcely more than 50 feet high. Swan Lake is clear and cold, and is about three-fourths of a mile long by one-third as wide; its depth is not more than 2 or 3 feet, except in a few holes. The bottom is diatomaceous ooze.

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Breaking camp on the Kakhtul September 3, we soon entered the flat country where the river, now considerably larger, begins to divide its channel as it passes [illegible] many small wooded islands. The current

[illegible]

accidental death at an early age was a distinct loss to science. He evidently made numerous short excursions from Nushagak, and among the localities thus visited were Lake Aleknagik and Ugashik. He also made a trip over a considerable part of the route traveled by our party. He visited Lake Iliamna and Iliamna Village, and, according to an account received from a native, crossed the Chulitna portage. By a strange coincidence, the same native who, as a young man, accompanied McKay on this trip, went with us from Lake Clark to Swan Lake, and related to us various incidents of the trip made twenty years before. By another coincidence, while at Nushagak we lodged in the old log house which was the home of McKay. On some shelves in one of the rooms we found, still untouched, several pounds of his arsenic and some of the old station records of his meteorological work.

McKay was succeeded by J. W. Johnson, who was ordered from Washington, D. C., to Fort Alexander, on April 21, 1884, and directed to return from there April 12, 1886. Johnson made natural history collections, including 125 specimens of birds, which were sent to the National Museum. In all important cases these have been recorded in the present list.

Aside from the natural history work of McKay and Johnson, nothing of importance, previous to 1902, was done anywhere in the region of the base of the Alaska Peninsula.

LIST OF MAMMALS.

Balæna sieboldi (Gray). Pacific Right Whale.

The carcass of some species of baleen whale was washed ashore early in September, 1902, between Kanatak and Wide Bay. When we arrived at Kanatak the natives had secured great quantities of the blubber. This they had cut in strips and chunks and hung up in most of the available places about the village. Our natives, who came with us from Igagik, were much elated at the chance of securing some of the blubber. They lost no time in bargaining for a small quantity, which they carried back with them, intending to use the oil to grease their bidarkas. For this purpose they say it is far superior to the seal oil, which they ordinarily use. Two white men from Cold Bay visited the carcass and secured the baleen from one side of the jaw, the other half having been washed away. They estimated by pacing that the animal was about 63 feet in length. The baleen was rather coarse and short, the largest pieces being not more than 2 feet in length. The amount secured weighed approximately 250 pounds.

Delphinapterus leucas (Pallas). White Whale.

White whales or belugas often come into the mouth of the Nushagak River or the neighboring small bays in pursuit of salmon, on which it is said they feed quite extensively. When a school appears, the natives become much excited and make every effort to secure as many as possible. The skins of the belugas are highly valued, particularly for covering kyaks and bidarkas. Belugas are said to occur also on the south side of the peninsula, about the mouth of Cook Inlet.

Phocæna phocæna (Linn.). Harbor Porpoise.

Two skulls of the common harbor porpoise, secured from the natives of Kanatak, were added to our collection by A. G. Maddren in the fall of 1903. So far as I can learn, this is the most northerly record of this species on the Pacific coast.

Rangifer granti Allen. Peninsula Caribou.

Signs of caribou were seen at the upper end of Lake Clark, along the Chulitna and Kakhtul rivers, and near Becharof Lake. The animals were formerly very abundant in all this region, but are now much reduced in numbers. Their distribution, however, is undoubtedly continuous from the peninsula to the mainland of Alaska by way of the region of lakes Iliamna and Clark, and the idea that the supposed species *granti* is entirely isolated from the other caribou of Alaska is unquestionably erroneous.[a] The few tracks of caribou seen were those of solitary individuals or of very small bands of five or six. Several caribou were killed by natives in July, 1902, some 20 miles northwest of Keejik, Lake Clark. One was also killed in July by a prospector about 15 miles northeast of Cold Bay. During the winter of 1901 a herd of 20 was seen by natives between Becharof and Ugashik lakes, and several were killed, and in the winter of 1902–3, 7 were killed on Becharof Lake near Smoky Mountain. Two skulls, labeled 'Nushagak,' secured by McKay in 1882, are in the National Museum. They were doubtless procured by natives at some distance from Nushagak. A party of natives, encamped near us at the mouth of Becharof Lake, were engaged, in the latter part of September, in a caribou hunt. During two weeks of steady work six hunters succeeded in killing a total of 6 animals. Their method is a lazy one, but with unlimited time gives a fair degree of success. They built a small, innocent-looking cairn of rocks on the summit of a hill a few hundred yards from their camp, to which one of them would go every hour or two and scan the surrounding country. In case a caribou was sighted, the whole party would then go out to stalk it. The animals are very light-colored at this season and are easily seen at a long distance.

The large herds which occur farther west on the peninsula do not, as a rule, come as far east as Becharof Lake, although small herds are scattered all along. These herds are being rapidly killed off both by white men and natives, and at the present rate the caribou of the Alaska Peninsula bid fair to be exterminated in a comparatively short time. Nearly the year round they are brought in regularly to all the mining and fishing camps along the peninsula, being hunted not only for their flesh but also for their skins, which are in great demand. The mail steamer which runs along the south side of the peninsula takes on a supply of caribou meat on nearly every trip. The animals are usually killed in the Port Moller region, and the carcasses taken to the mining village of Unga, where the steamer makes regular stops. On the October run, when I was a passenger, caribou chops, roasts, and stews were a feature of the bill of fare. On each trip since then a good supply has been on board. On the December run 9 carcasses were secured at Unga for consumption on the vessel, and in January about the same number were consumed, as I am informed from reliable sources. In September, 1902, a trading post was established at Unangashik, east of Port Moller, on the north side of the peninsula, for the express purpose of trading for caribou skins. A stock of goods representing an investment of about $1,000 was put in, and a man placed charge. One of the employees of the proprietor of this station formed me that the receipt of about 1,000 caribou skins was confi ently expected during the following year. Since then I have learned at approximately 500 caribou were killed by the natives of Unanga ik between October 1, 1902, and May 1, 1903, and the skins disposed to the trader. These skins are not shipped out of the country, so e traffic in them is only locally known. The trader pays about $1 in ade for a skin, which is worth to him from $2 to $5. The skin of e body is widely used for clothing and bedding material. The short aired skin of the legs is especially desired for making the tops of the in boots which are very extensively used by natives and whites alike. his traffic is carried on openly. The occasional killing of caribou at of season by natives and prospecting parties can not be stopped, or does it seem necessary that it should be. If the wholesale traffic meat and hides, however, is not checked, the animals are surely oomed to speedy extinction.

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[a] See Allen, Bul. Am. Mus. Nat. Hist., XVI, p. 127, March 31, 1902, and Grant, *7th Ann. Rep. N. Y. Zool. Soc.*, p. 15, 1902.

The Aleut name for the caribou is Itooitoo; the Indians call it Búdga.

ce americanus gigas (Miller). Alaska Moose.

Moose are found in comparatively small numbers in the region of akes Iliamna and Clark. Near the head of Lake Clark two weather aten shed antlers were found on a wooded flat, and old tracks of one nimal were seen near there. The natives say that moose are not ten killed in this vicinity and were not abundant in times past. We w more signs of them on the upper Chulitna River, where in several aces near the portage to Swan Lake fresh tracks were found in the ft mud on the banks of small streams. A few signs were also seen n the Kakhtul River. The natives of Nushagak frequently go up e Nushagak River on hunting trips, but do not often bring back moose, as caribou and smaller game are much more abundant. Moose re scatteringly distributed on the Alaska Peninsula and extend farther est than has been generally supposed. In a native's camp on the gagik River I saw [illegible] pieces of the skin of a moose hich was killed about October [illegible] on the upper waters of the King almon River, a northeastern tributary of the Ugagik. One of our uides, an intelligent native from Ugashik, said that he killed two nall moose near the Ugashik [illegible] in the fall of 1902. [illegible] the pring of [illegible] A. G. Maddren [illegible] Naknek River. A [illegible] as said to have been killed [illegible] Port oller, but [illegible] of the [illegible] obtained. [illegible] except the Naknek iver, [illegible] little [illegible] Along the King Salmon River and bout the Ugashik lakes [illegible] there is a considerable growth of oplar and willow and possibly [illegible] birch, and the moose are found there regularly. If they ever do occur as far west as Port Moller, it must be only as stragglers. As to the westward distribution of the moose, Mr. Maddren, from his experience in 1903, writes as follows:

> In regard to the moose extending down the peninsula beyond the limit of spruce, it seems to me their range is governed by the limits of the birch which they eat. Birch extends beyond the limits of the spruce, growing thickly on the Naknek River and over into the valley of the King Salmon. This is practically the limit of moose range, though a few may wander down south of Becharof as stragglers, but no quantity of birch grows south of Becharof Lake.

The Indians of Iliamna call the moose Kóchtai, and the Aleuts at Igagik have it Toondoókbuk.

Ovis dalli kenaiensis Allen. Kenai Sheep.

White sheep are found in small numbers in the mountains between Lake Clark and Cook Inlet, and are probably more or less continuously distributed from there northward along the Alaskan Range. They are not reported from the mountains near Iliamna Bay, so it is probable that they do not occur farther west than the vicinity of Lake Clark. In winter they are said to come to the mountains immediately bordering Lake Clark, but at the time of our visit, in July, they had crossed to the next range to the eastward. I found one old weather-beaten skull in the mountains near the head of the lake. Two specimens are in the National Museum, collected by McKay in the 'Chigmit Mts.' This locality perhaps refers to the mountains near Iliamna Village, where it is probable McKay obtained the specimens from the natives. I have examined one of these specimens and find it referable to the subspecies *kenaiensis* rather than to true *dalli*. *O. d. kenaiensis* appears to possess other characters besides the slight cranial peculiarities noted in the original description.[a] Most noticeable of these is the color of the upper side of the tail, which is dusky or brownish in true *dalli* and pure white in *kenaiensis*. The horns of *kenaiensis* average thicker at the base, particularly on the lower side, and less divergent at the tips than in *dalli*. I have not examined specimens of *kenaiensis* in all pelages, but in those seen there is no mixture of dusky hairs on the back and sides as in *dalli*, the pelage being entirely pure white except for extraneous stains.

The Indians of Lake Clark call the white sheep Noótyee.

Sciurus hudsonicus Erxleben. Hudson Bay Red Squirrel.

Red squirrels were found sparingly in the timbered regions. Their characteristic nests were seen only occasionally, and their chattering calls, usually such a feature of travel in the northern woods, were not often heard. This scarcity of red squirrels is doubtless because they reach the extreme western limit of their range in this region. Speci-ens were taken at the following localities: Nogheling Portage, Lake lark (near head), mouth of Chulitna River, Nekahweena Lake, south ork Chulitna River, Kakhtul River near Malchatna junction. These e all referable without hesitation to true *Sciurus hudsonicus*.

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[a] Allen, Bul. Am. Mus. Nat. Hist., XVI, p. 145, April 23, 1902.

The Indians of Lake Clark call the red squirrel Tsilkár.

tellus plesius ablusus Osgood. Nushagak Ground Squirrel.

[illegible] Proc. Biol. Soc. Wash., XVI, pp. 25-26, Mar. 19, [illegible]

Spermophiles were found on the higher ground all along our route. he first ones seen were on the hillsides on the north side of Iliamna Pass, some in comparatively bare rocky places and others in little swales where the tall grass partly sheltered them from view. They were not found in the low country in the immediate vicinity of Iliamna Village, or between there and the upper part of Lake Clark. Scattering individuals were found on the mountains about the head of Lake Clark, and a few specimens were taken there. A few pairs were found occupying a short stretch of beach on Lake Clark, where their burrows were made in sandy sediment so soft and fine as to seem almost impracticable for the purpose. They also occur on the hills back of Koojik, whence one specimen was brought by an Indian boy who had been keeping it for a pet. Spermophiles were not seen along the Chulitna River, which flows through low, swampy country, but the natives report their occurrence on most of the higher ground in the vicinity. Several small mountains, visible from Nekahweena Lake, are said to be inhabited by spermophiles of a larger size than those ordinarily found in the region, and therefore particularly sought by the natives. A more or less continuous colony of several hundred individuals was found about the Chulitna-Swan portage, extending from the north base of the 'Portage Mountain' around the upper end of Swan Lake. Several specimens were taken there. Others were taken on low hills near the K[illegible] River [illegible] of Nushagak and Cold Bay. In 1902 A. G. Maddren [illegible] the Becharof Lake region. At Nushagak [illegible] sandy bluffs along the river. Their burrows [illegible] of the bank, 2 or 3 feet below the top [illegible] to the top and down the bank to the [illegible]. Some [illegible] were seen sitting in front [illegible] over the water, and [illegible]. At other times they were [illegible] would [illegible]. Several [illegible] of Nushagak were taken to [illegible] Mr. Samuel Applegate, of the [illegible] States Signal Service. [illegible] has since prospered, and [illegible] specimens have been secured for the United States

National Museum by various Government parties. Specimens taken on Lake Clark in July are in a fresh but short-haired pelage; those taken in late August and early September are changing to a much longer, fuller pelage, in which the buffy colors are reduced in intensity or replaced by grays. October specimens from Cold Bay are entirely changed and the buffy under color of the preceding pelage has been entirely replaced by grayish white. The Cold Bay specimens are not typical *ablusus*, but at present can be referred to no other form. The animals were more or less active at Cold Bay as late as October 18, although comparatively cold weather was prevailing. Six adults were weighed before skinning, with the following results: Males, 1½ pounds, 1¼ pounds, 1¼ pounds; females, 1¼ pounds, 14 ounces, 14 ounces.[a]

In the Aleut dialect, sometimes used by the natives at Iliamna village, the spermophile is called Anánuchgh; in the Kenai Indian of the same place, Koónschar; and in the dialect spoken at Igagik, Kanánuk.

Marmota caligata (Eschscholtz). Hoary Marmot.

The 'whistler' is said to occur on the mountains about Iliamna Bay and is also reported from the hills back of Keejik on Lake Clark. We failed, however, to find it on the mountains around the head of the lake. It lives in small colonies, and may be abundant on one particular mountain and entirely absent from all the others in the vicinity. A solitary mountain visible from Neekahweena Lake is said to support such a colony, and others are said to occur similarly on individual mountains near Kanatak and Cold Bay. One specimen, a skull from Kanatak procured by W. J. Fisher of Kodiak, is in the Biological Survey collection, and 16 others from the same locality are among the specimens received from the Kanatak natives by A. G. Maddren. McKay's collection contained two specimens from Aleknagik Lake.

The Indian name for this species is Skoótlah, and the Aleuts call it Chigíghbúk and Kangánughbúk.

Castor canadensis Kuhl. Beaver.

Three beaver lodges, evidently being used, were seen on the Chulitna River, two on the lower river below Neekahweena Lake, and one on the south fork near the Swan portage. Tracks in soft mud banks and fresh cuttings of alder and willow bushes were seen quite frequently. We had no large traps, and time was very valuable, so no attempt was made to trap the animals, although several unsuccessful nocturnal expeditions were made in the hope of obtaining a shot at one. The lodges were small and perhaps occupied temporarily, each by only one animal. They were roughly dome-shaped, about 6 feet in diameter and 3 to 4 feet high, having been excavated on the inside somegak series, all the immediately available specimens from northern Alaska were examined, several hundred in number. From a study of these it appears that the slight cranial peculiarities supposed to characterize specimens from St. Michael, which have been called *alascensis*, are covered by individual variation. Indeed, this variation, upon reexamination, is found to exist in the St. Michael series itself, so that *alascensis* should be considered a synonym of *dawsoni*. The reference of Nushagak specimens to *dawsoni*, therefore, is not unwarranted by geographical considerations. Throughout the series examined there is extremely little variation in color. The winter pelage is shown by October specimens from the Ugaguk River, Becharof Lake, and Cold Bay. It is brighter and clearer reddish on the back and paler on the sides than the preceding pelage.

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[a] These weights, as well as those of other species, were secured with spring scales, which have been carefully tested and found to be reasonably accurate.

Microtus operarius kadiacensis (Merriam). Kodiak Vole.

Voles of the '*operarius* group' were found all along our route, but were rather uncommon except at Nushagak and the region immediately surrounding the mouth of the Nushagak River. Specimens were taken at the following localities: Iliamna Bay, Iliamna Village, Lake Iliamna at Nogheling Portage, head of Nogheling River, mouth of Chulitna River, head of Chulitna River, Kakhtul River, Kakwok, Nushagak, Becharof Lake, and Cold Bay. At Nushagak they were exceedingly abundant and fairly swarmed about the houses in the village as well as in much of the surrounding country. They invade the vegetable gardens and do considerable damage, particularly to potatoes, which they dig out and carry to underground storehouses. The Indian boys at Kanulik, near Nushagak, found several of these places well filled with small potatoes. The trails of the voles and the small mounds of earth in front of their burrows were found from the hillsides to within a few feet of high-water mark on the beach. It was scarcely possible to walk 50 yards anywhere in the vicinity of the village without encountering signs of them. Evidently they continue to breed until the beginning of winter weather, as small young were taken in September. One very tiny little fellow was found one cold, rainy evening, doubtless having wandered so far from the nest that he was unable to find his way back. He was so small that his weight was easily supported by the blade of coarse grass on which he was perched. A large series of specimens was taken at Nushagak, and scattering individuals at other points along the route. All of these seem to be more similar to *kadiacensis* than to typical *operarius*, though to a slight extent they partake of the characters of each. From the examination of a very large series of both it appears that in color *operarius* and *kadiacensis* are absolutely alike, and that in cranial characters they are very closely related. The cranial characters are not invariable, but seem to hold true in the majority of cases. In *kadiacensis* the skull

from those of *Microtus* by their slightly smaller diameter and by their situation in moss rather than grass and weeds. In one place near the mouth of the Chulitna River they occupied a small boggy place which had become partially filled with decaying logs and dead branches overgrown with moss. Their runways perforated the entire mass in all directions, taking advantage of the situation at every possible point.

In our entire series of 24 specimens nearly all ages are represented, from young just out of the nest to very old, battle-scarred males. They show but little variation in color. Some of the slightly immature ones have a uniform brownish cast to the whole pelage, but the majority have the coloration so characteristic of all the species of the subgenus *Mictomys* and do not differ from specimens from other parts of Alaska. There is considerable variation in cranial characters, most of which is due to differences in age. These variations are particularly in respect to the shape of the nasals and the size of the audital bullæ, indicating that some of the characters supposed to distinguish *S. dalli* from *S. wrangeli* may not prove constant when good series of both are compared. The average measurements of 10 specimens, males and females, are as follows: Total length, 127; tail vertebræ, 19.2; hind foot, 18.7.

The natives of Lake Clark call the lemming mouse Kunjoónee, the same name also being used for the genus *Lemmus*.

Lemmus minusculus sp. nov.

Type from Kakhtul River near its junction with the Malchatna River, Alaska. No. 119612 U. S. National Museum, Biological Survey Collection. ♂ ad. September 1, 1902. W. H. Osgood and A. G. Maddren. Original number 1903.

General characters.—Similar in general to *L. alascensis* but much smaller; color of anterior parts less contrasted with that of rest of body; skull slightly characterized.

Color.—Under parts and lower sides nearly clear ochraceous or tawny ochraceous; pervading color of upper parts also ochraceous but accompanied with considerable mixture of black and blackish, which is usually somewhat concentrated medially to form an indistinct line from the nose to the shoulders; rump patch hazel or light chestnut, less extensive and less contrasted than in *alascensis* and *trimucronatus*; ears dusky or occasionally with a few ochraceous hairs; base of whiskers dusky; feet seal brown; tail variable, sometimes dusky or blackish above and light buff below, and sometimes nearly uniform pale buff above and below.

Skull.—Similar to that of *alascensis* but very much smaller; zygomata less angular and bowed out; audital bullæ more nearly parallel, usually more inflated and less inclined to be compressed anteriorly; basioccipital and basisphenoid correspondingly slender; naso-frontal region decidedly elevated and rostrum depressed.

Measurements.—Average of 10 males from the type locality—total length, 131; tail vertebræ, 12; hind foot, 19; of 5 females—122, 12, 18.5. Skull: Greatest length, 28.5; basilar length of Hensel, 25.4; zygomatic width, 19; mastoid width, 15; nasals, 8.9; diastema, 8.8; postpalatal length, 12.2; upper molars, 8.

Remarks.—Lemmings were first met with at the upper forks of the Chulitna River, where two specimens were taken August 17. They were again found on the south fork of the river at the Swan Lake portage, and again on the Kakhtul River near its junction with the Malchatna, and on the Nushagak River near Kakwok. Signs of them were seen at various places between these points. They were found for the most part in the tundra-like openings in the forest in both moist and comparatively dry situations. The low, sloping banks of small ponds where there is particularly rank vegetation seem to be especially chosen by them. In these places their runways were found in labyrinths weaving through the moss and in and out among the roots of the shrubby plants, particularly those of the dwarf birch (*Betula glandulosa*). The runways were very well beaten and evidently much used. Many very small young were taken, but breeding was evidently about over. One pregnant female containing 4 embryos was taken on the Kakhtul River August 29, and another containing 6 on September 1. A series of 58 specimens was secured, representing various ages from very small young to adults. In color they show little variation, some few being more suffused with ochraceous than others. Many of the adults are in bright, fresh-looking pelage, but the hair is rather short and in some the pelage is quite worn. None of them approach *L. alascensis* in size, and the slight differences in color and cranial characters which distinguish them are quite constant.

Dicrostonyx nelsoni Merriam. Nelson Pied Lemming.

The catalogues of the National Museum record 4 specimens of this lemming collected by McKay at Nushagak. All were taken in midwinter—one in 1881, two in 1882, and one in 1883. True, in recording them, quotes McKay's notes as follows: "Not very common. Found in the tundras, etc." Careful search for signs of these mice was without success. A few small burrows, possibly of *Dicrostonyx*, were found in some sandy banks near the lower end of Becharof Lake, but excavation proved them deserted.

Zapus hudsonius (Zimmermann). Hudson Bay Jumping Mouse.

Jumping mice occurred sparingly throughout the wooded region. They were also found beyond the limits of coniferous trees at Iliamna Bay and Cold Bay. Apparently favorable conditions for them exist in much of the tundra region, and it is possible that they may range a short distance into it. A badly mutilated specimen, killed by dogs, was seen at the head of Iliamna Bay; another, in similar condition, was seen at Cold Bay by Maddren. Several were taken in the se about small ponds near Iliamna village, and in similar places alon Nogheling River, and near Keejik on Lake Clark. Others secured near the head of the south branch of the Chulitna River, Kakwok on the Nushagak River, and at Nushagak. In all cases were taken in tall grass or sedge, in moist situations. They were however, in several instances in the daytime in tall grass on comp tively high, dry ground.

Our specimens are much smaller than typical *Zapus h. alascensi* plainly referable to true *hudsonius*. The hind foot in adults meas 31 mm., which is about the extreme in *hudsonius*, indicating a pos slight difference in size. The skulls are indistinguishable from th from Hudson Bay.

Two specimens of *Zapus* taken by McKay at Nushagak and reco by True were the first jumping mice to be reported from Alaska

The natives of Lake Clark call the jumping mouse Un-gúy-ah.

Erethizon epixanthus myops Merriam. Alaska Porcupine.

Alaska porcupines are found sparingly throughout the region. general way their range corresponds to that of the coniferous fo but they have a great fondness for the aments and young leaves of alder, which probably accounts for their occasional or possibly re occurrence in the tundra region. Two skulls, secured by Maddr 1903 from the Kanatak natives and said to have been taken near head of Becharof Lake, attest the occurrence of the porcupine siderably beyond the conifers on the peninsula. We found only along the Kakhtul River, where two specimens were t The natives of Lake Clark say that porcupines are quite comm that vicinity. An adult male taken on the Kakhtul River Septem weighed 26 pounds. McKay's collection contained four speci from Kakwok and Nushagak.

The native name for porcupine is Náinee. The Aleuts call Esháluk.

Ochotona collaris (Nelson). Collared Pika.

Pikas were not found on any of the mountains visited, alth conditions seemed to be favorable for them in nearly all cases. Indian guide insisted that they were to be found on a small mou which he called Keejik Mountain, near Keejik Village, on Lake C As he described them fairly well and imitated their bark, it seems p able that they are there. Two specimens are in the National Mus collected by McKay in the Chigmit Mountains, which, in this probably refers to the mountains northeast of Lake Iliamna. T in his list of McKay's mammals, quotes from McKay's notebo regard to these specimens as follows: "Said to be very plentif the mountains. The Indians in their vicinity have a supersti dread about killing them, and can not be hired to do so."

Lepus othus Merriam. Alaskan Arctic Hare.

Arctic hares inhabit the treeless region around Bristol Bay and out on the Alaska Peninsula probably for its entire length. They occur very sparingly, however, and, although we spent considerable time within their range, we failed to see any or any fresh signs of them. During 1903, A. G. Maddren secured a small series of skulls from Cold Bay, Kanatak, and the Becharof Lake region. These agree in all important respects with topotypes of *othus* from St. Michael, and fail to show the narrow rostrum of *poadromus* from the western part of the Alaska Peninsula. Two specimens taken by McKay at Nushagak are recorded by True.

The Aleut name for the Arctic hare is Ushkánuk.

Lepus americanus dalli Merriam. Dall Varying Hare.

Common throughout the timbered region. Hares were especially abundant about Lake Clark and along the Chulitna River, where their conspicuous runways were encountered nearly every time we went ashore. These runways are usually most numerous in low ground, not too wet, but thickly carpeted with moss, although this preference is not very decided. In following them one is led uphill and down, through moss, grass, or brush, across open flats or through dense forests, and over rocky knolls or through wet swamps where water often stands several inches deep in the runways themselves. In summer the hares feed largely on the tops of the dwarf birch which abounds. About Lake Clark we seldom saw a clump of it that had not been nipped. They also eat twigs of other small shrubs and occasionally try green grass stems, long cuttings of which we sometimes found in their runways. Specimens were easily secured, and a small series, chiefly from Lake Clark, was preserved. These are very similar to specimens of true *americanus* from Hudson Bay, and there is considerable variation among them, nearly sufficient to cover the characters of *dalli*. There is, however, a slight average difference.

Lynx canadensis (Kerr). Canada Lynx.

We saw no signs of the Canada Lynx, and were informed by the natives that it is of rather rare occurrence in the region.

The Kenai name for it is Kăśhznah; the Aleut is Etóchtoolik.

Canis albus (Sabine).[a] Northern Wolf.

Wolf tracks were seen on a few of the beaches of Lake Clark and also about the portage from the Chulitna River to Swan Lake. We saw a skin of one that had been killed by prospectors in the winter of

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[a] Possibly the Alaska wolf is separable from other northern forms, but until this is determined the name *albus* Sabine, 1823, may be used. The only name prior to *albus* is *mexicanus* Linn., 1766, which unquestionably applies to another form. Say's name, *nubilus*, which is of even date with *albus*, may be disregarded on the same grounds.

1901 near the Malchatna River. Wolves are said to be common on the Alaska Peninsula, but we failed to see or hear them, or even to find their tracks.

Vulpes alascensis Merriam. Alaska Red Fox.

Foxes are very abundant on the Alaska Peninsula, and fairly common in the adjacent regions to the northeast through which we traveled. Their tracks were frequently seen about Lake Clark and along the Chulitna River. On August 24, near Swan Lake, W. L. Fleming saw a bright-colored red fox running rapidly along a ridge. The following day, while crossing the portage, I surprised one that was calmly browsing on huckleberries on the side of a little gully. Later, members of the party saw foxes on several occasions on Becharof Lake and at Cold Bay, where several specimens were taken. During the winter of 1902-3 the natives of Kanatak trapped over 100 red foxes, chiefly about the head of Becharof Lake. Twelve perfect specimens were secured from them by Maddren, besides a splendid series of 50 skulls. A few skulls were obtained from natives at Kakwok and Ikhok on the Nushagak River. Fox tracks were seen in great numbers on all the sandy beaches about Becharof Lake. According to the natives they are to be found in similar numbers all along the peninsula. Specimens from Becharof Lake and Cold Bay are decidedly more richly colored than *V. fulvus*. The pervading color is deep hazel, except where diluted by creamy white; it is most concentrated on the middle of the shoulders and on the upper side of the tail. The face, nose, and forehead have considerable admixture of white hairs, but the predominating rufous effect is much deeper than in *V. fulvus*. The flesh measurements of two young adults from Cold Bay are as follows: Male—total length, 1,115; tail vertebræ, 440; hind foot, 188. Female—total length, 1,040; tail vertebræ, 375; hind foot, 175. The skulls of the Cold Bay specimens differ from the type only in having slightly more slender zygomata and longer and narrower nasals. In these respects they approach *abietorum*. The type, which is a male, agrees in size of teeth with females from Cold Bay, and is slightly smaller than the males from the same place.

McKay's collection contained "two very fine male specimens (13618, 13619) from Nushagak, captured on February 20 and 15, 1882, respectively." (True, Proc. U. S. Nat. Mus., IX, p. 221, 1886).

Vulpes lagopus innuitus Merriam. Continental Arctic Fox.

Straggling individuals of the Arctic fox are not infrequently found as far south as the north shore of the Alaska Peninsula, doubtless having followed the pack ice in winter. One was killed by fishermen near Igagik in the spring of 1902. They are also said to be found in the Togiak district and very rarely at Nushagak.

Ursus americanus Pallas. Black Bear.

The Indians of Iliamna Village say that according to tradition a few black bears were formerly found in the mountains northeast from there, but that in recent years none have been seen. As far as we could learn they do not occur elsewhere in the region. Their westward limit on the Pacific side of the peninsula is about coincident with that of the coniferous trees, which cease a short distance east of Iliamna Bay. The westernmost records of the black bear known to the writer are those of two killed at Chinitna Bay in 1901 by the party of J. H. Kidder, of Boston, Mass.[a] Two specimens of small cubs secured by McKay from the Kakwok Indians in 1882 were questionably referred to *Ursus americanus* by True. These may, however, have been the young of the large brown bear.

The Kenai Indians call the black bear Yerdeéshlah.

Ursus kidderi Merriam. Kidder Bear.

Ursus dalli gyas Merriam. Peninsula Brown Bear.

Brown bears were formerly abundant in much of the country through which we passed, but the persistent hunting by the natives since the introduction of modern repeating rifles has reduced their numbers greatly. They still occur in many localities, but have become extremely shy and are seldom obtained unless a special campaign for them is conducted. In the course of our entire trip we saw remarkably few signs of bears. In fact, the only really fresh tracks seen were those of a medium-sized one which had been fishing along a small stream emptying into Lake Iliamna near the Nogheling portage. This region about Lake Iliamna was formerly a favorite hunting ground for the natives. Chief Michaluf, of the small remaining village known as Iliamna Village, enjoys the reputation of being the greatest bear hunter of his generation, having, according to local report, scores of bears to his credit. There are yet a good many bears in the vicinity of this big lake, and a few have been killed each season in recent years. Several old bear trails were found on the mountains near the head of Lake Clark. In following them we noticed a few 'bear trees' with the bark torn off and the trunks scored with claw marks. The highest scratches were found to be only 7 feet and 9 inches from the nearest place where a bear might stand, indicating that no very huge individuals had passed that way. In all cases the trees marked in this manner were white spruce. Considerable old 'sign' of bears was seen along the Kakhtul and Nushagak rivers, but the fishing season was over and the big fellows had presumably retired to the mountains, though no traces of them were found during the limited trips we made away from the water courses. We saw very little 'sign' along the Ugaguk River and Becharof Lake. The natives say that this is not a good place for bears, though they are quite common about the Ugashik lakes near there.

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[a] Outing Magazine, Jan., 1903, p. 474.

The following notes on the habits of the brown bears of the Alaska Peninsula are largely such as have been derived from old native hunters. Most of the statements have been corroborated to a certain degree by independent discussion of the same subjects at different times with different individuals. As to the former great abundance of these bears there can be no doubt. The records of the fur traders do not fairly indicate this, for bearskins have usually been comparatively low priced and the natives have been urged to secure the smaller, more valuable, and more easily handled furs. Not more than fifteen years ago it was not uncommon to see from eight to fifteen bears scattered about on one mountain side. Those natives who have had an opportunity to see cattle feeding on the hills of Kodiak Island invariably compare them to the bears they saw in their younger days. Pioneer white men also say the same of the great abundance of the animal in the not very distant past. The season of activity of the bears varies, but is usually from the latter part of March or early April to the early part of November. They are not particularly averse to snow, and their tracks are often seen in it, but the date of their retirement in fall and of their reappearance in spring depends upon the severity of the season, so that sometimes they may go in as early as October and not come out until April. Sometimes, when disturbed, they come out for a short while in midwinter. Their dens are chosen in rocky, remote places in the mountains, to which they are sometimes tracked by the natives, both with and without the aid of dogs. The young are always born before the female comes out of her winter quarters. The date of birth is ordinarily sometime in January, doubtless varying considerably in individual cases, for during the summer cubs of different sizes may be seen on the same date. At birth the young are blind, naked, and helpless; they vary in number from one to four. Two is the usual number, three is not very uncommon, while four is quite rare. They follow the mother until the end of their second summer, when they are often nearly as large as she is.

Although numbers of the adults frequent some localities, it is generally safe to assume that three or four bears found together constitute one family. The cubs are mischievous and playful and receive many a stern reproving cuff from their mother. The brown bears avail themselves of everything the country affords in the way of food, including fish, flesh, fruit, roots, and grass, a variety that was scarcely exceeded by the natives when under aboriginal conditions. When they first come out in the spring, they eat young grass, herbage, and roots, and if they are near the coast, take a little kelp. In securing and handling these as well as their other food they display much deftness and a control of their foreclaws seldom accredited to their kind. In the spring they also enjoy, now and then, a meal on a ground squirrel (*Citellus*). Hunting these squirrels and digging them out seems to be a combination of business and pleasure for the bears, and the antics they go through are very interesting to the onlooker. The bear is usually so intent on the game that he himself is easily approached. Sometimes he slips along a hillside and tries to catch the squirrel by a sudden pounce, but this usually fails. When the squirrel dodges into its near-by burrow, new tactics are adopted. The bear immediately begins to dig, throwing out big turfs and clods at each stroke, using the left hand chiefly and watching the hole intently all the time. While this is going on, the squirrel sometimes runs out between the legs of the bear and makes for another hole. Possibly he is caught by a quick pounce. If he escapes, excavations begin immediately at the new hole. The bear digs for a few strokes, and then stops to poke his nose into the hole and sniff. Finally his efforts are successful and the luckless squirrel is devoured.

As soon as the salmon begin to enter the streams, bruin makes fishing his chief business. He varies his diet somewhat, however, and occasionally leaves the streams for the mountain sides, but in a short time returns again to the fish. The fish in large numbers usually ascend the streams for the entire summer, and the supply is practically unlimited. In fishing the bears do not get all their prey in shallow water or on bars and riffles in small streams, as is generally supposed, but often go into comparatively deep water in large streams. Practically all the fishing is done at night or very early in the morning; though their habits in this respect have doubtless changed in recent decades, since they have been hunted so much. It is most interesting to watch an old she bear with cubs. The cubs do not attempt to fish, but stay on the bank and receive contributions. The old she bear stands upright and wades in water even up to her neck, going very slowly with the current, watching the water and scarcely making a ripple in it. She holds her arms down at her sides with her hands spread, and when she feels a salmon coming up against her, clutches it with her claws and throws it out on the bank to the expectant cubs. Often she stands perfectly motionless for a considerable time, and when she moves, it is with extreme deliberation and caution. After supplying the cubs she puts the next fish in her mouth and goes ashore to eat it. If salmon are plentiful or easily obtained, the two sides of a fish are all that she will eat; sometimes she even scorns these and fastidiously crunches the head and leaves the rest. The gills are never eaten. The cubs are not so particular, but chew their portions haphazard. In case they have any difficulties among themselves in apportioning the tidbits, they are promptly cuffed by the parent.

When fishing in shallow water, the bear walks slowly on all fours as silently as possible, and when a fish appears in a riffle deals it a sharp blow on the head. During the fishing season the bears make deep trails in the grass along the bank, where at short intervals bones and other remnants of salmon in large quantities testify to bruin's ability as a piscatorial sportsman. Occasionally by following some of the branches of these trails one may discover the midday resting place of the nocturnal fishers. One that I saw on the Kakhtul River was an ideal retreat. A soft bed was made in the grass and moss under the thick shelving branches of a small spruce. Around this small alders and willows formed a sort of inclosure which opened on one side and gave an outlook upon the river. The whole place had an air of coziness which would appeal to anyone accustomed to selecting camping sites. In the fall, toward the end of the salmon run, when fishing becomes unprofitable, most of the bears retire to the hills, where they feed on berries and put on fat during the last few weeks preceding hibernation. The black crowberry (*Empetrum nigrum*) is eaten in great quantities, and various species of *Vaccinium* which abound are also taken. In moving up and down the mountains the bears usually follow the ridges, as shown by their trails, which often indicate years of use. These old trails do not resemble ordinary game trails, which are merely paths, but each consists of a succession of distinct, irregularly oblong indentations in the turf, alternating from side to side, a sort of composite of the prints that have been made by many feet during many seasons. These depressions become nearly 18 inches in length by 10 inches in width and from two to four inches in depth. They are often quite conspicuous and can be seen for a considerable distance.

The two types of coloration commonly shown by these species of bears, the dark brown and the light brown or even creamy, do not seem to be anything more than color phases or individual variations. I have examined numbers of skins, and, in all lots exceeding a half dozen, both phases, or modifications of both, were represented. Moreover, the natives tell me that they have often seen a light and a dark cub following the same mother. A certain amount of this difference in color among the adults may be seasonal, but it does not seem probable that it is entirely so, for skins of both general types are frequently seen in the same apparent condition, and are alleged to have been secured at the same season.

The geographic distribution of the various forms of the Alaska brown bears is still imperfectly known. Even the range of the group as a whole is not thoroughly understood owing to the impossibility of distinguishing them from grizzlies in reports which come from localities not represented by specimens. *U. dalli gyas* extends westward at least from Cook Inlet to and including Unimak Island; large bears are found also on Nunivak Island and on the coast of Bering Sea from Bristol Bay northward, and probably range over much of the northern and western part of Alaska. To what extent the group ranges into the interior of the Territory is not known, and specimens with good skulls and reliable data from any point in the interior are greatly desired.

Lutra canadensis (Schreber). Land Otter.

Land otters were formerly quite common on the Iliamna River, and a few are still obtained there every year. They are also found along the shores of Iliamna Lake and on some of the small islands in the lake, as well as on Lake Clark. Considerable 'sign' of otters was seen on the Swan River, and one evening three of the animals were startled from the bank as we were floating downstream near the junction of the Swan and the Kakhtul. On sighting the canoe they plunged into the water and swam frantically downstream at about 10 yards from the shore, evidently making for refuge in holes in the bank. We were on the other side of the river and crossed the current with some difficulty, being so much interested in watching the evolutions of the otters that we did not get within shotgun range of them until they hauled out on the bank about 100 yards below the point from which they started. A charge of buckshot was fired at the last one as he was leaving the water, but, though wounded, he managed to escape. The animals swam with great rapidity, proceeding by a succession of leaps and dives and coming clear out of the water like porpoises.

Otters are quite common in the vicinity of Becharof Lake, and are said to be found in considerable numbers all along the Alaska Peninsula. Their trails were frequently found along small streams emptying into the lake, and generally ran through tall grass, up and down and along the banks. Several skins taken in the vicinity of the lake were brought in October by natives to be traded at Cold Bay. An immature specimen from the Nushagak River was contained in McKay's collection as recorded by True. One complete specimen and several skulls from Becharof Lake were secured in 1903 by Maddren.

The Aleut name for the land otter is Ah'kwéeah; the Kenai Indian is Chweeneélingoch.

Lutreola vison melampeplus Elliot. Kenai Mink.

In spite of continued trapping by natives for furs, the mink is still fairly common in much of the region of the base of the Alaska Peninsula. It is said to be found in small numbers along the Iliamna River. More or less 'sign' of it was found along the Nogheling, Chulitna, Kakhtul, Nushagak, and Ugaguk rivers, but usually at such times and under such circumstances that any attempt to secure specimens was impossible. Tracks were frequently seen in soft mud along the narrow course of the south branch of the Chulitna. While gliding down the stream one dark night with a native in a bidarka, I startled a mink at a sudden bend in the stream. It did not perceive us until we, also unaware, were within a few feet, and then, instead of diving as might have been expected, it dashed up the bank and away through the long grass and low bushes, making a great commotion. Two specimens were secured near the head of Becharof Lake and three at Cold Bay, and several odd skulls were obtained from natives on the Kakhtul and Nushagak rivers. These, on account of their large size and very dark color, and particularly on account of the absence of any white pectoral spot, are provisionally referred to *L. v. melampeplus* Elliot,[a] although they have not been compared with specimens from the Kenai Peninsula, the type locality of *melampeplus*. The five skins from Becharof Lake and Cold Bay are all characterized by uniform dark underparts without the usual white pectoral patch.[b] The measurements of the largest male are as follows: Total length, 660; tail vertebræ, 220; hind foot, 73. Other males, respectively: 647, 215, 70; 651, 212, 70. Females: 563, 189, 61; 557, 190, 63. Weights: Male, 3 pounds; female, 1¾ pounds.

At Iliamna Village the mink is called in Aleut Émachamŏoduk; in Kenai Yarkeéchah; at Igagik it is Kō'chcheechuk.

Putorius arcticus Merriam. Arctic Weasel.

One weasel was secured at Nushagak and another near the head of Becharof Lake; several others were added to the collection in 1903 by A. G. Maddren. Six specimens were taken in 1881 by McKay at Ugashik.

The Indians of Iliamna Village call the weasel Tahkiák and Kahoólcheenah; the Aleuts call it Ameetáhduk.

Mustela americana Turton. Marten.

Evidently quite rare, as we heard very little of it from the natives. This might naturally be expected, as it is a forest-loving animal, and the region under consideration is on the edge of its range. The natives of Iliamna call it Kcheegóchah.

Gulo luscus (Linnæus). Wolverine.

Wolverines are found sparingly throughout the region, being rather common on the Alaska Peninsula. A few skins were seen in the trader's store at Nushagak. The traders take advantage of the natives' peculiar fondness for the coarse fur of the wolverine as trimming for heir garments, and never ship the skins out of the country, but resell hem to the natives at high prices. A single skin obtained from a native in urgent need of provisions, for from $2 to $5 in trade, is sometimes cut up into sections and bartered piecemeal for other furs o the value of as much as $30.

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[a] Field Columbian Mus., Zool. Ser., III, pp. 170–171, April, 1903.

[b] Since this was written a series of eight skins and a large number of skulls from Becharof Lake have been received from A. G. Maddren. These show the same dark color, four of them being without trace of white and the other four with only very tiny spots on chin and breast. Specimens without white are very rare in *L. v. energumenos*, which usually has an extensive pectoral patch. A single specimen from Tyonek, Cook Inlet, was previously referred to *energumenos* (North Am. Fauna, No. 21, p. 69, September, 1901), its dark brown immaculate underparts being regarded as due to individual variation. With a series of fourteen specimens, in all of which the white markings are nearly or entirely obsolete, it now seems evident that a recognizable subspecies occurs in the Cook Inlet and Alaska Peninsula region.

The Aleut name used for the wolverine at Iliamna Village is Drăk-inyuk; at Igagik it is Măchăwhă'luc; the Lake Clark Indians call it Brŭsháh.

Latax lutris (Linnæus). Sea Otter.

The coast of the Alaska Peninsula from Iliamna Bay westward was formerly much frequented by sea otters. Kamishak Bay was a favorite hunting ground for the natives of Iliamna Village and others. Even within the last five years parties have hunted otters there with considerable success. A sea otter is occasionally secured by hunting from shore in calm weather, when the animal may come in near enough to be shot. The hunter stations himself on a high lookout, usually a rocky bluff, and carefully watches the water. If an otter is seen within rifle shot, and a lucky shot is made, the chances are good that the prize will be secured. One was taken in this manner in December, 1902, at Wide Bay, and another the preceding winter near Cold Bay. One skull secured by Maddren from a Kanatak native is in our collection.

The Aleut name for the sea otter is Ah'chgh-nahchgh.

Erignathus barbatus nauticus (Pallas). Western Bearded Seal.

Phoca nautica Pallas, Zoog. Rosso-Asiat., I, pp. 108–109, 1811.

A young bearded seal was killed by natives near our camp on the Ugaguk River October 3. I offered a variety of articles in exchange for its skin, but all were scornfully rejected. The skull, however, was secured for a trifle. The natives prize the skin very highly on account of its great utility as material for making the soles of their skin boots. It was also used formerly for making kyaks and bidarkas, but on account of its scarcity its use has now become restricted almost entirely to the making of boot soles. The flesh and blubber of this seal are also much in favor with the natives. Their name for the animal is Makluk, very similar to "mukluk," which is what their skin boots are called.

On comparing the skull from the Ugaguk River with others from Greenland and the eastern coast of North America several slight differences were noticed. These cranial characters are constant in the small series from each side of the continent which I have been able to examine, and I have therefore adopted the name *Phoca nautica* of Pallas for the bearded seal of the northern coasts of Alaska and Siberia. Several skulls from Plover Bay, Siberia, agree with those from the

Alaska coast, which confirms the belief that the Bering Sea form is a general entity as contrasted with the form of the northeastern Atlantic coasts. The most obvious and constant character of the skulls from Bering Sea is the shortness of the nasals. They are shorter and wider than in typical *barbatus*, and correspond to a general brachycephalic condition of all parts of the skull. The brain case is wider and fuller; the rostral portion of the skull anterior to the infraorbital foramina is heavier and thicker, and the palate, basisphenoid, and basioccipital are wider. Another possible character is shown in the lack of a decided space between the last two upper molars. In the skulls which I have seen, this space is very pronounced in typical *barbatus* and almost or totally lacking in *nauticus*.

Phoca richardi Gray. Pacific Harbor Seal.

The skulls of seven harbor seals taken by natives along the Alaska Peninsula between Kanatak and Katmai were secured in the fall of 1903 by A. G. Maddren. The adults of these agree essentially with skulls from the Pribilof Islands, and in case the subspecies *pribilofensis* proves entitled to recognition they should be referred to it.[a] Among the immature ones are several, strictly comparable, which do not differ from the only available skulls of true *richardi* from Puget Sound.

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[a] Doctor Allen's recent separation of the northern hair seals under the name *pribilofensis* may fairly be called provisional, since the available material was admittedly a rather meager basis for such separation. (Cf. Bull. Am. Mus. Nat. Hist., XVI, p. 495, Dec. 12, 1902.) While admitting the probability that the seals of Bering Sea may differ subspecifically from those of Puget Sound, I am unable to appreciate any characters whatever after an examination of all the material now available. Even if the alleged characters should prove real and constant, there still might be some question as to the advisability of recognizing three forms on the Pacific coast, for it would be a case of two extremes (*geronimensis* and *pribilofensis*) and an intermediate (*richardi*). The differences between the extremes being only of size, and these not very marked, there would scarcely seem to be room for more than two definable forms.

In the light of Doctor Allen's careful study of the seals of the North Pacific, it is evident that the name *Phoca largha* can no longer be used for the hair seals of the Alaskan coast. The summary disposition of the name altogether as entirely unidentifiable is surprising, however. Like many other names (possibly the majority) proposed by early authors, this one applies equally well to several species. It is restricted to a reasonably definite locality, and is not composite in the ordinary sense of the term, but merely insufficiently diagnosed, as judged by recently established standards. Therefore, to be consistent, it should be restricted to one of the forms to which it unquestionably applies, as has been done in many similar cases. Its rejection at the present time is largely a matter of accident, for if we suppose a different history of the knowledge of the animals, there would now be no question as to the use of the name. That is, if specimens of only one of the three spotted seals of Kamchatka had come into the hands of a modern naturalist, instead of all three at the same time, the name *largha* would have been applied to it without question, and the subsequent discovery of the other two could not have affected its status in the least.

A spotted seal is reported as a permanent resident of the fresh aters of Lake Iliamna. While in this vicinity we made efforts to ecure specimens of this seal from the natives, and Maddren tried gain in 1903, but none were obtained. All reports are to the effect hat it differs from the ordinary harbor seal, but the only character entioned by the natives is size, some stating that it is larger and thers that it is smaller than the salt-water form. Most of those illed are said to have been found in the Kvichak River or in the ake near the outlet into the river, which seems to indicate that the nimals, whether distinct or not, go back and forth from Bristol Bay o Lake Iliamna.

The Aleut name for the seal is Ishoóik.

dobenus obesus (Illiger). Pacific Walrus.

A very limited number of walruses still occur about some of the small islands in Togiak Bay west of Nushagak, and on the north coast of the Alaska Peninsula in the vicinity of the native village of Unangashik. Large quantities of walrus bones, witnesses of bygone slaughters, are to be found at various points along the peninsula. One such place was reported by the fishermen of Igigik, who had recently found it while on a hunting trip near there. From their accounts, the remains must be in great quantities. The trader at Nushagak informed me that in recent years he had obtained annually from 9 to 15 walrus tusks from the Togiak region. He intimated that the natives had given him to understand that they would not be able to get many more. A sailor from Nushagak visited Unangashik in August and September, 1902, and while there saw five walruses. They haul out on a sand spit near this place, but seldom get far from the water. Clams, which they feed on, are abundant there. The same man stated that he was at Unangashik with a trophy hunter in the previous year, at which time they secured several of the ponderous animals. They also visited Togiak Bay, but found no walrus.

Sorex personatus arcticus Merriam. Arctic Shrew.

Shrews of the *personatus* type were found sparingly all along the route, being most common in the coast region. The entire series collected numbers 44 specimens. In color they are not definitely distinguishable from true *personatus* of the eastern United States, but after comparing them with series of true *personatus* I am inclined to refer them to *arcticus* on the basis of cranial characters. In the Alaskan specimens the skull is characterized by small size and general lenderness; by a narrow and rather high braincase; and by having he palatomaxillary region between the upper unicuspids rather bruptly narrowed. Specimens from Cook inlet, previously referred to *personatus*,[a] possibly represent a slight tendency toward the large dark form *streatori*, although they are very much nearer to *arcticus* and *personatus*.[b]

Sorex obscurus shumaginensis (Merriam). Shumagin Shrew.

Sorex alascensis shumaginensis Merriam, Proc. Wash. Acad. Sci., II, p. 18, Mar. 14, 1900.

This shrew was not found about Lakes Iliamna and Clark, but several specimens were taken on the Kakhtul River near its junction with the Malchatna. From that point on to Nushagak it was found in considerable numbers. It was also taken on the Ugaguk River, Becharof Lake, and at Kanatak and Cold Bay. It is found about the houses in the village of Nushagak in company with *Microtus* and *Evotomys*. Specimens taken early in October were beginning to acquire the dark plumbeous winter pelage, and by the middle of the month the change had been completed in the majority of cases. In the brown pelage preceding this, the color is the same as that of *shumaginensis* from the type locality, and somewhat paler than in *alascensis*. The skulls are practically identical with those of *shumaginensis* and smaller than those of *alascensis*. On comparing the Nushagak series and others from the same vicinity with typical *obscurus* from the United States, a surprising resemblance is found; in fact, some specimens of each, although of slightly different dimensions, are almost indistinguishable either by color or by cranial characters, which increases the probability that the two forms have a continuous range by way of the interior of Alaska and northwestern Canada.

Sorex (Microsorex) eximius Osgood. Northern Microsorex.

One specimen of this rare shrew, an adult female, was taken by A. G. Maddren on the south branch of the Chulitna River near the portage to Swan Lake. Its skull is not quite so elongate as that of the type specimen, but otherwise agrees with it.

Myotis lucifugus (Le Conte). Little Brown Bat.

Several bats were seen in July at Iliamna Village and near the head of Lake Clark, but no specimens were taken. At this season they do not fly until quite late in the evening, sometimes not until 11 o'clock and later. Even if one denies himself sleep until this hour and is then able to shoot them, the chances of retrieving them are slight on account of the dense vegetation into which they usually fall. One specimen is recorded by True as secured by McKay in the spring of 1882 on Lake Iliamna.

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[a] Cf. N. Am. Fauna No. 21, p. 70, 1901.

[b] Doctor Allen's recent reference of Cook inlet specimens to *streatori* is difficult to understand in the face of the measurements he publishes, which are decidedly smaller than those of *streatori*. In referring specimens to *S. alascensis* he is equally inexplicable, since he states that they differ from true *alascensis* in precisely the characters which distinguish *shumaginensis* from *alascensis*. Cf. Bull. Am. Mus. Nat. Hist., N. Y., XVI, pp. 228–230, July, 1902.

LIST OF BIRDS.

tymbus holbœlli (Reinh.). Holbœll Grebe.

A fine adult male of this species was taken at Nushagak by McKay, tober 12, 1881, and the specimen is now in the National Museum. other is recorded as taken at Point Constantine, Bristol Bay, May , 1882.

ymbus auritus Linn. Horned Grebe.

Several small grebes, assumed to be this species, were seen at the per end of Becharof Lake October 6-7. McKay took a specimen at shagak June 21, 1881.

via adamsi (Gray). Yellow-billed Loon.

A large loon, either this species or *G. imber*, was killed and eaten natives at Cold Bay October 17. This was the only large loon seen us. An immature specimen is in the National Museum, collected at ashik, across the river from Nushagak, September 21, 1882.

via pacifica (Lawr.). Pacific Loon.

This was the most common loon on the lakes and rivers. It was und on the Nogheling River, the Chulitna, the Swan, Kakhtul, and shagak, as well as about many small ponds a short distance back om the rivers. It was exceedingly abundant along the Chulitna iver, where from 8 to 15 individuals were seen almost daily. These re generally seen going up and down the river, flying singly or re often in pairs, about 100 yards above the water and religiously llowing the course of the stream. They were quite wary and we ldom approached one on the water nearer than 150 yards, even when were slipping noiselessly downstream. The adult birds, sitting on e water at a little distance, appear as if their heads were entirely hite, particularly if a ray of sunlight bears on them. The rapidity th which they swim under water is amazing, as we repeatedly served when one would dive at a point about 150 yards in front of r canoe and in a few moments appear at about the same distance stern. Being unable to carry such large birds we preserved no ecimens. Specimens were taken by McKay and Johnson at Nushaak, Cape Constantine, and Ugashik.

avia lumme (Gunn.). Red-throated Loon.

A pair flew by camp on the Chulitna River on the evening of gust 12, and a few others were seen at comparatively long intervals along this river and the Kakhtul. They were far exceeded in numbers by the Pacific loon. Specimens were taken at Nushagak by McKay.

Lunda cirrhata Pall. Tufted Puffin.

Four tufted puffins were taken by J. W. Johnson at Nushagak May 9, 1885. The species was not seen by our party.

Fratercula corniculata (Naum.). Horned Puffin.

The catalogue of the U. S. National Museum records three specimens of the horned puffin taken at Nushagak by J. W. Johnson May 9, 1885. I have been unable to find them.

Cyclorrhynchus psittaculus (Pall.). Paroquet Auklet.

A paroquet auklet (No. 106604, U. S. N. M.) was taken near Nushagak by J. W. Johnson May 22, 1885.

Simorhynchus cristatellus (Pall.). Crested Auklet.

Two specimens were taken at Nushagak by J. W. Johnson, April 22, 1885. One was taken by McKay at Nushagak and one at Ugashik.

Brachyramphus marmoratus (Gmel.). Marbled Murrelet.

Several murrelets (apparently this species) were seen on Kanatak Bay, October 13. A single immature specimen (No. 106605 U. S. N. M.) was taken near Nushagak by J. W. Johnson, September 5, 1885.

Brachyramphus brevirostris Vigors. Kittlitz Murrelet.

Three specimens of this rare murrelet were taken by C. L. McKay at Point Etolin, near Nushagak, April 3, 1883.

Cepphus columba Pall. Pigeon Guillemot.

Five specimens were taken near Nushagak by J. W. Johnson, May 20–22, 1885.

Uria troile californica (Bryant). California Murre.

Five specimens were taken near Nushagak by J. W. Johnson, April 20–22, 1884. No murres were seen in this region by our party in September and October.

Stercorarius parasiticus (Linn.). Parasitic Jaeger.

One specimen of the parasitic jaeger in the dark phase was taken by McKay on the Ugashik River, July 28, 1881. The species was not seen by our party.

Stercorarius longicaudus Vieill. Long-tailed Jaeger.

A single long-tailed jaeger was seen among a few gulls on Lake Iliamna, July 16. Specimens were taken by McKay at Nushagak and Ugashik in July and August, 1881.

Rissa tridactyla pollicaris Ridgw. Pacific Kittiwake.

A few kittiwakes were noticed among the numerous gulls at Nushagak September 12–26. Two specimens were taken at Ugashik by McKay September 11, 1881.

Larus glaucescens Naum. Glaucous-winged Gull.

A large gull occasionally flew over camp at Iliamna village, and numbers were seen on Lake Iliamna July 16–17. Gorman reports them in very large numbers at the lower Nogheling rapids, where natives were catching large quantities of salmon in August. They are said to breed on many of the islands in Lake Iliamna. They were very rarely seen on Lake Clark, and none were found along the Chulitna River. A solitary gull appeared at intervals near Swan Lake, and scattering individuals were seen from there on down to the mouth of the Tikchik River. From the mouth of the Tikchik they were in immense numbers—thousands without doubt. At the time we passed down, the salmon run was practically ended, but it had been a very large one and the banks of the river were strewn with dead fish, upon which the gulls were regaling themselves royally. During the few days we were passing down this stretch of the river, hundreds of cackling, screaming gulls were overhead from morning till night. As soon as one flock tired of following, another white cloud would rise from its resting place on one of the long, smooth sand bars and accompany the party until thoroughly satisfied as to its character. Apparently one species monopolized the salmon business, for I saw none that I did not take to be *glaucescens*. Some were so fat that they seemed to fly with difficulty, and many showed a prominent abdomen and general corpulency quite unlike the usual trim appearance of their kind. They were abundant on the mud flats and about the salmon canneries at Nushagak, but there they were mixed with other species. Many were also seen at Igigik and on Becharof Lake, where they are said to breed in some numbers. About the lake they appeared only in scattering numbers except at the mouths of the small salmon streams, where they fairly swarmed. They were also seen at Kanatak and Cold Bay, where they often afforded us amusement by their maneuvers against the high winds that were prevailing while we were there. One specimen was taken at Nushagak by McKay, but at present I am unable to find it in the National Museum.

Larus brachyrhynchus Rich. Short-billed Gull.

A small gull, supposed to be this species, was seen on Lake Iliamna near the Nogheling portage July 17. The species was not seen again until we reached a point on the Nushagak River about 25 miles above Nushagak, where it became common. It was quite abundant at

Nushagak, probably outnumbering all other gulls. A few were seen at Igagik and from there to Kanatak and Cold Bay. Specimens were taken at Nushagak by McKay.

Larus philadelphia (Ord). Bonaparte Gull.

A pair of these beautiful gulls in full plumage was seen hovering solicitously about a sandy beach on Lake Iliamna July 16. A short search failed to disclose the nest, which was evidently located in the vicinity. The species was not met with elsewhere. Specimens were taken by McKay and Johnson at Nushagak, Lake Aleknagik, and Ugashik.

Xema sabinei (Sab.). Sabine Gull.

A single specimen of the Sabine gull was taken by C. L. McKay at Lake Aleknagik September 2, 1881.

Sterna paradisæa Brünn. Arctic Tern.

A few were seen on July 16 on Lake Iliamna, where they doubtless breed on some of the numerous islets. None were seen after this date by our party. Specimens were taken near Nushagak in May and June by McKay and Johnson.

Diomedea albatrus Pall. Short-tailed Albatross.

Two specimens were taken by McKay on Bristol Bay near the mouth of the Ugashik River July 20, 1881. The species was not seen by us except in the north Pacific.

Puffinus tenuirostris (Temm.). Slender-billed Shearwater.

The National Museum catalogue records one specimen of this bird taken near Ugashik by McKay September 15, 1881. The entry does not seem open to question and is probably correct, though the specimen is not now at hand to substantiate it.

Oceanodroma furcata (Gmel.). Fork-tailed Petrel.

Several specimens were taken at Nushagak by Johnson and at Igushik and Ugashik by McKay.

Oceanodroma leucorhoa (Vieill.). Leach Petrel.

One specimen of the common petrel was taken at Ugashik by McKay December 3, 1881.

Phalacrocorax dilophus cincinatus (Brandt). White-crested Cormorant.

Cormorants occasionally flew over our camp at Iliamna Village while on the way to and from their nesting places on some of the islets in Lake Iliamna. On July 16 we passed several small rookeries, where the birds could be seen in considerable numbers coming and going or standing in groups on the rocks near the water's edge. Several were seen flying up and down the Nogheling River July 21, doubtless following their usual highway between the two large lakes. One specimen was taken by Maddren on Lake Clark August 2, and a few others were seen about the upper end of the lake, but evidently very few, if any, breed there. After leaving Lake Clark no more cormorants were seen until we reached the Malchatna River a short distance above the mouth of the Tikchik, when this species again appeared and was seen daily thence to Nushagak, but not in great numbers. Several were seen on Becharof Lake October 4 to 7.

Phalacrocorax pelagicus Pall. Pelagic Cormorant.

The pelagic cormorant was not seen on the lakes and was found only in rather small numbers in the lower Nushagak River, on Bristol Bay, and on Becharof Lake. Specimens were taken at Cape Constantine and Ugashik by McKay, and at Nushagak by Johnson.

Merganser americanus (Cass.). American Merganser.

The National Museum catalogue records one specimen of the American merganser taken by McKay on the Nushagak River, October 15, 1881. With the exception of one adult male among a number of ducks killed by natives on Becharof Lake, I think none of the mergansers seen were referable to this species, all others being *M. serrator.*

Merganser serrator (Linn.). Red-breasted Merganser.

Exceedingly abundant on all the lakes and rivers visited by us. Camp had barely been pitched on the banks of the Iliamna River, near Iliamna village, July 12, when an old female merganser with a flock of 11 young came sailing down the current of the river. During the two following days this family party was seen every few hours. When alarmed, the old bird dove or flew, and the little fellows flapped their tiny down-covered wings and paddled frantically with their little feet, streaking over the water upstream against a strong current, at an almost incredible speed. Many such families of young of various ages were seen along the Chulitna, Kakhtul, and Nushagak rivers. Whenever we approached near enough to alarm them, this performance was repeated, their frantic efforts to get out of harm's way being often quite ludicrous. Flocks of 8 to 15 young adults were frequently seen on the lower Nushagak, and scarce a half hour passed while we were traveling on the rivers that one or more individuals were not in sight. From start to finish probably more mergansers were seen than any other species of water bird, with the exception of the large gulls. Two downy young were taken at Iliamna village, and adults were killed, but not preserved, on the Nushagak River. McKay took specimens at Nushagak and Lake Aleknagik.

Anas boschas Linn. Mallard.

An old female of this species in very poor flesh was shot in a grassy overflow swamp at the mouth of a small stream near the head of Lake Clark; two others in similar condition, with no primaries except short pinfeathers, were taken at the mouth of the Chulitna River August 4. No others were seen in this vicinity, but their familiar quack was heard frequently as migrating flocks flew over on the nights of August 7, 8, and 9. In spite of this scarcity of mallards on the Chulitna side and indication that they were moving south, they began to appear later on Swan River. Thence to the end of our route they were more or less abundant, probably outnumbering all other fresh-water ducks. On Swan River, nearly every turn of the stream or little bight, where slack water gave opportunity for a growth of grasses and water weeds, harbored at least a pair of mallards, and often a small flock. From the junction of the Swan and the Kakhtul rivers to the mouth of the Tikchik very few were seen, as the banks are unfavorable and covered with spruce timber; but from the mouth of the Tikchik down the Nushagak to its mouth they were very abundant September 3 to 12. Here they were found on the open, barren sandbars or in shallow coves near them where the pebbly bottom afforded but little growth of vegetation, so that it scarcely seemed possible that they were feeding. They were found in such places, however, at all times of the day, from the first streaks of dawn until it was quite dark. Others were found along the numerous sluggish branches of the river in more favorable feeding places; but by far the greater number were out on the main river, among the thousands of gulls, geese, and cranes, along the stretches of sand. One foggy morning, as we were slipping down the current of one of the narrow side channels, a brace of mallards flew across a small peninsula to our left and alighted in a little cove, whence they hauled out on the muddy bank. Thinking to secure a good fat duck for dinner, we quickly swung the canoe into an eddy and paddled upstream toward the little cove. One of the birds flew while out of range, and at about the same time the other somehow disappeared, although there was but a small patch of grass for concealment. Expecting the bird to rise at any moment, we paddled on but were beginning to feel baffled, when just before the canoe touched the bank, we found our game giving a very pretty exhibition of its confidence in protective coloration. It was a female mallard, and lay on the brown mud bank, strewn with dead grass and decaying matter, which blended perfectly with the markings of its back. It was not merely crouching, but lay prostrated to the last degree, its wings closely folded, its neck stretched straight out in front of it with throat and under mandible laid out straight, and even its short tail pressed flatly into the mud. The only sign of life came from its bright little eyes, which nervously looked at us in a half hopeful, half desperate manner. When a paddle was lifted, with which it could almost be reached, the bird started up and was allowed to escape with its well-earned life.

Mallards were seen in large flocks at Nushagak September 16 to 26; a few flocks were also seen about Becharof Lake, and one was killed at the head of the lake as late as October 16. High-flying flocks of ducks, apparently mallards, were seen at Cold Bay October 20. McKay found the species breeding at Nushagak and took a number of specimens there in May and June, 1881.

Mareca americana (Gmel.). Baldpate.

Several specimens were taken by McKay at Cape Constantine and at Ugashik September, 1881. The species was not seen by us.

Nettion carolinense (Gmel.). Green-winged Teal.

Green-winged teal were very scarce on the interior lakes and rivers. One old female was seen on the Nogheling River July 21, and no more appeared until we neared the coast on the lower Nushagak River. Immense flocks were seen in late September in the vicinity of Nushagak. McKay obtained several specimens at Nushagak and at Ugashik.

Spatula clypeata (Linn.). Shoveller.

One specimen was taken near Nushagak by McKay August 14, 1881, and another September 24, 1882. The species was not seen by our party.

Dafila acuta (Linn.). Pintail.

No pintails were seen by us among the large flocks of other ducks met along the Nushagak River. Numerous specimens were taken from June to August at Nushagak by McKay and Johnson.

Aythya marila (Linn.). Scaup Duck.

Scaup ducks, doubtless this species, were seen in small flocks along the Nushagak River September 4 to 9. McKay took them in May and July at Nushagak and Ugashik.

Clangula islandica (Gmel.). Barrow Golden-eye.

One was seen on the Nogheling River July 20, and one was killed there some days later; another was shot by W. L. Fleming on a small pond near the head of Lake Clark July 28. Several immature birds were killed at the mouth of the Chulitna River August 4. Rather common at intervals along the Chulitna River August 12 to 17; generally seen in family parties of 6 to 10. Near Swan Lake a flock of about 15 was seen feeding on a shallow lake in company with a flock of 10 swans. Seen almost daily in pairs or small flocks along the Malchatna and upper Nushagak September 3 to 6.

Charitonetta albeola (Linn.). Buffle-head.

Two specimens were seen at Cold Bay October 17 among some ducks killed on the bay by natives. One was taken at Nushagak by McKay May 2, 1882.

Harelda hyemalis (Linn.). Old-squaw.

A few old-squaws were seen on the Nushagak River, about 25 mile above its mouth, September 11. Others were seen in small flocks from this point to Nushagak, and they were also common on Bristol Bay, between Cape Etolin and Igagik. Several parties of them were seen on the lower Ugaguk River September 29. Most of these were immature birds. Those that were killed were found to be very good eating, though of a decidedly different character from mallards, which were sometimes baked in the same pan.

Histrionicus histrionicus (Linn.). Harlequin Duck.

Seen in small flocks along the Ugaguk River and in and about the mouths of the larger streams that empty into Becharof Lake; common on salt water at Kanatak and Cold Bay. They spend much time out on the open water with other species of ducks, but frequently leave their company to visit the mouths of small streams or to ascend them for considerable distances. When slightly startled on a stream they do not fly, but keep at a safe distance from danger by allowing the current to carry them downstream, unconcernedly passing through riffles and rapids, and deftly avoiding, without apparent effort, the rocks and whirlpools.

Among the considerable number that we killed, none were in adult plumage, nor were any such seen, all being birds of the year. Specimens were taken at Igushik and Nushagak by McKay and Johnson.

Polysticta stelleri (Pall.). Steller Duck.

Evidently a common duck about Bristol Bay, but not seen by us as we made no attempt to collect large birds. McKay and Johnson collected it as follows: Nushagak, May 20, August 14, October 8; Ugashik, July 17, November 12, November 28.

Somateria v-nigra Gray. Pacific Eider.

Eiders were found in great abundance about Bristol Bay and at Nushagak. Good-sized flocks were seen all along the Ugaguk River as well as on Becharof Lake. One specimen, a young male in transition plumage, was taken near the head of Becharof Lake October 7. Large flocks were seen at Kanatak and at Cold Bay. McKay secured specimens at Cape Constantine and Ugashik.

Somateria spectabilis (Linn.). King Eider.

Evidently quite common at Nushagak and about Bristol Bay, and doubtless seen by our party, but not recognized. McKay took several specimens at Nushagak and also at Ugashik.

Oidemia americana Swains. Scoter.

A few American scoters with broods of small young were seen on ponds a few hundred yards back from the shore of Lake Clark July 25

Females with young were also seen occasionally along the more sluggish courses of the Chulitna River. Scoters were common at Cold Bay, and specimens of this species were killed while we were there. Numerous specimens were taken by McKay and Johnson at Nushagak, Cape Constantine, Point Etolin, and Ugashik.

Oidemia deglandi Bonap. White-winged Scoter.

A flock of 6 was seen on Neekahweena Lake, about halfway up the Chulitna River, August 14. This was the only time we met with this species. Specimens were taken by McKay and Johnson at Nushagak, Cape Constantine, and Lake Aleknagik.[a]

Oidemia perspicillata (Linn.). Surf Scoter.

Surf scoters were not positively identified among the numbers of other species seen by us. Specimens were taken at Cape Constantine by McKay September 12, 1881.

Anser albifrons gambeli (Hartl.). White-fronted Goose.

Several white-fronted geese were killed on the Chulitna River in early August, and small flocks were seen frequently. One was taken on the Malchatna River, a few miles above its junction with the Tikchik, September 3. From this point down to Nushagak large flocks were seen daily, either flying noisily overhead or resting on sandy spits and islands. On the rare days or hours of sunshine they take life easily, squatting on the sand in large groups or waddling lazily and apparently aimlessly about on it.

Branta canadensis hutchinsi (Rich.). Hutchins Goose.

A flock of 10 flew over camp at the mouth of the Chulitna River August 5. The species was not seen again until we reached the Malchatna River, a few miles above its junction with the Tikchik. From this point down to Nushagak flocks were seen daily. This species seemed to outnumber the white-fronted, the only other species of goose that we saw. The two species do not mingle, but flock separately, though flocks of each were sometimes seen occupying respective areas on the same sand bar. Although there were a large number of geese in the region, we did not see such immense flocks as occur on the lower Yukon, possibly because the season was not far enough advanced. The largest flocks were of about 150 birds each. Their center of abundance seemed to be about midway between Kakwok and Nushagak.

Philacte canagica (Sevast.). Emperor Goose.

An emperor goose was collected by McKay at the mouth of the Nushagak River May 5, 1882. Two others were taken at Ugashik in the fall of 1881. A series of 11 specimens was also taken by McKay on Bristol Bay (exact locality not recorded) in May, 1881. Most of these have been exchanged or otherwise disposed of, and few are at present in the National Museum collection.

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[a] No. 92149, U. S. N. M., was recorded as *Melanetta fusca*, but proves to be *O. deglandi*. Cf. Ridgway, *Proc. U. S. Nat. Mus.*, VII, p. 68, 1884.

Olor columbianus (Ord). Whistling Swan.

More or less common, and breeding in suitable places along the Chulitna River, the upper waters of the Nushagak system, and near the Ugaguk River and Becharof Lake. Several were seen flying at a distance over the marshes about the mouth of the Chulitna River August 4 to 9, and a flock of 7 was seen on Neekahweena Lake, about halfway up the Chulitna River, August 14. One was shot on Swan Lake August 18 by one of our natives. This proved to be such a desirable addition to our bill of fare that effort was made to secure others, and within the next few days two more were killed on small lakes near Swan Lake. Several small flocks were seen flying over the swampy country between Swan Lake and the mouth of the Swan River August 27 and 28. No others were noted until September 29, when a line of 8 or 10 big snowy fellows was seen slowly winging over the lake-dotted tundra near the Ugaguk River. A few days later 2 specimens were killed from a large flock on a little lake near the southwest shore of Becharof Lake, October 5.

Wild swans in their natural habitat seem infinitely more beautiful than the domestic varieties in artificial ponds. On two occasions I was favored with opportunities of seeing them under conditions seldom equaled in an ornithological experience. The first was on the evening of August 14, on the beautiful little Neekahweena Lake, after a long day of hard paddling against the current of the Chulitna River. We entered the lake just after sundown and glided slowly across, enjoying the light of a glowing sky mirrored in absolutely placid water. When we were about midway, the soft musical call note of a swan attracted attention to several small white objects on the far side of the lake. The canoe was headed toward them while the natives imitated the call. In a few minutes the objects appeared larger, and seven of the great snow-white birds were distinguished slowly approaching, calling softly and swerving in and out among themselves, half curious and half timorous. As they drew nearer, we ceased paddling and remained perfectly silent, wrapt in the spectacle, until the swans were so near that their breasts and gracefully arched necks could be seen reflected in the glassy water. This occupied but a few minutes, as they soon decided that the situation was dangerous and took flight. Until they flew, the scene, in itself extremely impressive, was made doubly so by their presence.

At another time, while seeking a vantage point for taking a photograph near Swan Lake, I ascended a slight eminence from which I ked down through some scattered timber to a little silvery lake, inkling through the trees, and showing here and there spots of aite which I recognized as swans. After a short detour and considable crawling from tree to tree, good cover was reached on the bank the lake, from which I could thoroughly appreciate the beautiful ght of 10 stately swans, variously disposed, enjoying a quiet, lazy ternoon. The place was evidently much frequented, for many loose athers were scattered along the shore and on the water, and bits of ass and water weeds were floating about. Several were young birds the year, and though of large size were easily recognized by their venile manners. A flattened tussock in shallow water a few feet om the shore appeared to have been used as a nest earlier in the ason.

The flesh of the swan was found excellent eating, the young birds turally being preferable, though some of the older ones were not rticularly tough. In fact, swan was voted the best meat in camp, hen there was at the same time an abundance of young mallard, ouse, ptarmigan, and rabbits. The natives make various uses of e swan's skin, often taking it entire, exclusive of the wings, to make winter garment for a small child. The skin of the foot they use for aking a small bag or purse.

us canadensis (Linn.). Little Brown Crane.

Little brown cranes were first seen September 3 on the Malchatna iver, a few miles above the mouth of the Tikchik, and from that int down to the vicinity of the mouth of the Nushagak, they were ry abundant. The river for this distance abounds in islands and ng sand bars and spits upon which large water birds spend much of eir time. When not flying the cranes are seldom seen except on ese sand bars, where they mingle with the more numerous gulls and ese. On fine days they stand for hours in small groups enjoying e sun, scarcely ever making a move. Their unmistakable rattling, etallic cry usually kept one informed of their whereabouts when ey were flying anywhere within half a mile. They were quite wary d rarely came within gunshot. A specimen is in the National useum, taken by McKay, on the Nushagak River, 80 miles above its outh.

ymophilus fulicarius (Linn.). Red Phalarope.

A single phalarope, supposed to be this species, was seen on Becharof ake October 6. Two specimens, in full breeding plumage, were ken by McKay at Cape Constantine, Bristol Bay, May 15, 1883.

alaropus lobatus (Linn.). Northern Phalarope.

Two northern phalaropes were taken by McKay at Igushik May 24, 1882, and two others at Ugashik, July 15 and August 10, spectively. Our party did not meet with the species.

Gallinago delicata (Ord). Wilson Snipe.

Several were seen in tundra swamps, near the Kakhtul River, September 1, and a half dozen individuals were seen flying while we were descending the upper Nushagak September 4. A small flock was seen on the Ugaguk River September 29. One specimen was taken at Nushagak by McKay April 25, 1882.

Macrorhamphus griseus (Gmel.). Dowitcher.

One specimen (No. 92132 U. S. N. M.) was taken near Nushagak by McKay September 24, 1882, and another (No. 101228 U. S. N. M.) at the same place by Johnson June 9, 1884. Both of these are decidedly referable to *M. griseus* and do not even equal in length of bill the smallest specimens of *M. scolopaceus* available. The culmen of No. 101228 measures 52 mm., and that of No. 92132 is 60 mm. Both are labeled male.

Arquatella couesi Ridgw. Aleutian Sandpiper.

One flock of about 20 birds was found at Cold Bay, October 16, and specimens were secured. They were found as usual huddled closely together on a slippery, spray-washed rock, apparently oblivious of everything, and showing no particular interest in life. When startled they left as one bird, and with a slight twittering flitted around the first big bowlder and unconcernedly alighted in another dark, dank place. Numerous specimens were taken in April by McKay and Johnson.

Arquatella ptilocnemis (Coues). Pribilof Sandpiper.

Four typical specimens of the Pribilof sandpiper were taken by J. W. Johnson at Nushagak April 1-18, 1884.[a]

Actodromas maculata (Vieill.). Pectoral Sandpiper.

One was taken by Johnson at Nushagak October 15, 1884. The species was not seen by our party.

Actodromas minutilla (Vieill.). Least Sandpiper.

One was taken on the portage between lakes Iliamna and Clark July 19. A few others were seen at Keejik, Lake Clark, July 25. After that date no more were observed. One specimen which I have not been able to find is recorded as taken by McKay on the Aleknagik River June 16, 1881.

Pelidna alpina sakhalina (Vieill.). Red-backed Sandpiper.

Several small flocks were seen flying up and down the Ugaguk River September 29. None were seen on the mud flats about Nushagak, doubtless because the water there is brackish. McKay took several specimens in May and July, 1881, at Ugashik.

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[a] Cf. Palmer, Birds Pribilof Ids., Fur Seals and Ids. of N. Pac., pt. 3, p. 403, *Wash., 1899.*

Ereunetes occidentalis Lawr. Western Sandpiper.

In the National Museum are two specimens of this sandpiper collected by C. L. McKay at Nushagak July 30 and August 10, respectively.

Limosa fedoa (Linn.) Marbled Godwit.

Two immature specimens of the marbled godwit were taken by McKay at Ugashik July 16–18, 1881. These are recorded in the National Museum catalogue as '*Limosa hudsonica*,' together with two other specimens from the vicinity of Nushagak which I have not seen.

Totanus melanoleucus (Gmel.) Greater Yellow-legs.

A male bird was taken at Iliamna Village July 14. It came sweeping in zigzag flight down into a little pond and alighted near where I was setting a trap, startling me by its sudden loud outcry. A few days later we found a pair in possession of a small pond on the portage trail between Lakes Iliamna and Clark. During a great part of each of several trips that we made back and forth, they accompanied us, making noisy and belligerent demonstrations. Time was too valuable to search for the eggs or young, which were doubtless the cause of these outbreaks. Each time when we came within about a quarter of a mile of the pond, one of the birds would be heard in a loud, high-pitched 'yip! yip!'—at least three or four cries to the second. Presently, as we came nearer, one of them would be seen flying swiftly down the trail, about 5 feet above the ground. When within about 4 or 5 feet of us, it would suddenly swoop up a few inches overhead, and with a few wide careens, would alight after considerable balancing on the tiptop of a small spruce. In a few moments the performance would be repeated with some variations and continued until we were a half mile or more from the pond. During the entire time the pitch and pace of the cries did not abate in the least, and continued long after we had passed the danger limit, and the birds were out of sight. The long-legged birds perched on the topmost twigs of spruce trees looked very much out of place. When I went over the trail last, at midnight of July 18, the yellow-legs were as much excited as ever. The grotesque appearance they made on the tops of the spruces, silhouetted against a moonlit sky, was particularly noticed.

Yellow-legs were not again found until Swan Lake was reached, where one was seen frequently, standing in a few inches of water at the edge of a riffle in a small stream and watching the water intently. Another was seen on the Malchatna River September 3. Two specimens were taken by McKay at Nushagak August 14 to 28, 1881.

Actitis macularia (Linn.). Spotted Sandpiper.

When we arrived at Lakes Iliamna and Clark, in the latter part of July, the majority of the spotted sandpipers, which doubtless breed in the region, had migrated, and only scattering stragglers remained. One small flock of 8 or 10 hornotines was seen nervously flitting from point to point along the gravelly beaches of Lake Clark July 25. Some days later a few belated individuals were found along the lower part of the Chulitna River. Practically all were gone before August 10.

Numenius hudsonicus (Lath.). Hudsonian Curlew.

Three specimens of this curlew were taken at Nushagak by McKay in August, 1881. No species of curlew were seen by our party.

Squatarola squatarola (Linn.). Black-bellied Plover.

Two black-bellied plover were collected by McKay at Nushagak August 8 to 14, 1881.

Charadrius dominicus fulvus (Gmel.). Pacific Golden Plover.

A few small flocks were seen on the tide marshes and along the mud flats about Nushagak September 12 to 26. Several were seen at Igagik and others occasionally along the Ugaguk River, as far up as the mouth of Becharof Lake. Specimens were taken at Nushagak by McKay in June, 1881.

Ægialitis semipalmata Bonap. Semipalmated Plover.

McKay took one specimen of this species on the Nushagak River, 80 miles above Nushagak, June 25, 1881; another at Lake Aleknagik June 17, and another at Point Constantine, in Bristol Bay, May 15. It doubtless breeds commonly in the region, but was not found by us owing to our late arrival.

Aphriza virgata (Gmel.). Surf Bird.

One surf bird was taken by McKay at Nushagak August 9, 1881. The species was not seen by our party.

Arenaria interpres (Linn.). Turnstone.

One specimen was taken on the beach at Nushagak September 22, where it was frequenting the wharves and lumber piles in company with the black turnstone. One was taken by McKay at the same place August 12, 1881.

Arenaria melanocephala (Vig.). Black Turnstone.

One was taken and another seen on one of the islets near the middle of Lake Clark July 23. Turnstones were not met again until we reached Nushagak, where a flock of about half a dozen were seen daily along the beach in front of the village. Specimens were taken by McKay and Johnson at and near Nushagak and also at Ugashik in June and July.

Canachites canadensis osgoodi Bishop. Alaska Spruce Grouse.

A few small flocks were seen in the timber near Iliamna Village, *July 13–15*, and several scattered individuals between Lake Iliamna and the Nogheling River. They were found in abundance all about Lake Clark, being more common there than I have ever found them elsewhere in Alaska. We seldom made a landing or walked more than 100 yards into the timber around the lake without finding one or more grouse. They feed largely on berries in the summer time, being particularly fond of those of *Vaccinium vitis-idæa*, which they eat almost exclusively from the time the little green berry first begins to swell until it is dead ripe. At this time the flesh of the birds is sweeter than in the early winter, when a diet of spruce needles has made them fatter but less palatable. In the spruce forest which is their ordinary habitat, they are unable to obtain on the moss-covered ground the grit necessary for a gallinaceous bird, so they make daily excursions to the shores of the rivers and lakes where fine gravel is to be had in abundance. Early morning before sunrise is the time for this; then they may often be seen on the beaches, singly, in pairs, or in small flocks. Doubtless they also come to the rivers to drink, though pools are common enough in the swampy openings in the timber. On the Chulitna River one was caught in a steel trap which had been set for a possible mink or weasel in the marsh grass at the water's edge.

The range of the spruce grouse is practically coextensive with that of the spruce tree. We traveled much of the time near the western limit of the timber, and found grouse fairly common, even up to the edge of the tundra, where the spruce was considerably scattered. The last one seen was a fine cock, which was startled very early on the morning of September 10, from a small beach on the Nushagak River about 25 miles above its mouth. The grouse are said to occur within a very few miles of Nushagak, however. Specimens were taken by McKay at Lake Aleknagik.

Lagopus lagopus (Linn.). Willow Ptarmigan.

Willow ptarmigan were found in nearly all the tundra and semi-tundra regions along our route. In July old females, with partly grown young, were found on Iliamna Pass and about Lake Iliamna. They were also seen along the Nogheling River. In the thick timber about Lake Clark there are of course no ptarmigan, though they may occur on some of the mountains. They were abundant along the upper Chulitna River, and particularly so on the portage to Swan Lake. There, in the latter part of August, the young were still following their parents, though they quite equaled them in size. Whether the young are restrained by their parents who fear that they are not able to care for themselves, or whether the adults reluctantly remain with the young who are too timid to expose themselves, it seems that both old and young at this time seldom attempt to escape danger by flight. We repeatedly passed within a few feet of family parties of about a dozen birds which displayed small alarm, beyond a little craning of necks or a slight crouching, with now and then a warning cluck. Often they would not fly until almost stepped upon, and then only for a short distance. Once, while walking across the portage with a native, we came upon a small flock of ptarmigan and I witnessed a simple method of securing game without the use of shot and powder. Several of the birds were within about 20 feet, and stretched their necks to look at us from the farther side of some tundra hummocks, behind which they were standing. The native dropped on one knee, pulled out his jackknife, and without opening it tossed it lightly at one of the bobbing heads. The bird dodged the first throw and fluttered away for about 10 feet, enabling the native to recover the knife and try again. This time the knife just tapped the bird's cranium, causing it to flutter over, stunned. Before it could recover, its neck was wrung.

Willow ptarmigan were found along the Kakhtul and Malchatna whenever we went into the open tundra beyond the timber immediately bordering the rivers. Occasionally a few were flushed in the sparse timber near the edge of the tundra. Sometimes a pair or two were found on the mountain sides up to about 1,000 feet elevation, well within the domain of the rock ptarmigan. Like the grouse, the ptarmigan visit the gravel beaches along the rivers and lakes to obtain grit. A flock was seen on such a beach on the lower Nushagak River September 11. They were abundant on the tundra about Nushagak, and in the latter part of September were collected in large flocks. At one of our camps near Nushagak immense flocks came whizzing over the tent every evening just before dark, and sometimes for a short time after dark, evidently on the way to a resting place for the night. Earlier in the season, through late July and early August, we often heard the whirr of their wings at night near camp, as well as their half-croaking, half-rattling cry which seems to be an invariable and perhaps involuntary accompaniment of their flight. The food of the willow ptarmigan is much the same as that of the rock ptarmigan. Stomachs of birds taken in July contained berries of *Vaccinium* and *Empetrum;* those of a few weeks later were crammed with the aments of the dwarf birch, and those of still later date showed buds and leaves. Specimens in various plumages were taken, but our limited carrying capacity made it impossible for us to save large series. McKay and Johnson preserved large numbers from Nushagak, chiefly of birds in winter plumage, however.

Lagopus rupestris nelsoni Stejn. Nelson Ptarmigan.

A few pairs were seen on barren, rocky parts of the '*Portage Mountain,*' between the head of the Chulitna River and Swan Lake, August 19. They were unwary at this time and allowed approach within easy shotgun range. The natives recognize their distinctness from the willow ptarmigan and seem to think their differently pitched cry the most important consideration. They were again seen in the mountains on the Kanatak portage and about Cold Bay, October 12 to 26. At this time both rock and willow ptarmigans were to be found in the same flock, though in the more mountainous regions the former predominated. Although permanent snows had not yet come, the birds were rapidly losing the dark summer plumage, so that as they rested on the browned vegetation, their white bodies were very conspicuous, and could often be seen and recognized though more than a mile away on the mountain side. They had also begun their winter diet of buds, but obtained a larger variety than if snow had been on the ground.

An examination of the crops of 10 birds killed at Cold Bay showed a variety of food, but buds, particularly willow buds, predominated. Tiny buds and twigs of some small species of *Vaccinium* were found in large numbers, which must have been secured by a very tedious process. Some of the craws contained nothing but buds, others had a few leaves of *Dryas* and *Ledum*, and occasionally one contained some broken pieces of the large aments of *Alnus viridis*.

With the material at hand I have been unable to satisfactorily distinguish the rock ptarmigan of the Alaska Peninsula from those of Unalaska Island.

Lagopus leucurus Swains. White-tailed Ptarmigan.

Without being solicited, our guide, Zachar, a very intelligent native from Keejik village, described this species. He said that it was found in a few restricted localities in the mountains on the northwest side of Lake Clark.

Circus hudsonius (Linn.). Marsh Hawk.

One was seen near the mouth of the Chulitna River August 6, and others at intervals almost daily along the river. Several were seen along the Kakhtul River or beating over the swampy tundra back of it. Others were seen occasionally thence to Nushagak. Specimens from Nushagak of McKay's take are in the U. S. National Museum.

Accipiter velox (Wils.). Sharp-shinned Hawk.

A sharp-shinned hawk was seen giving battle to a pair of ravens on the Malchatna River September 3. The conflict was watched for fully fifteen minutes. During that time both sides won several apparent victories, but each time hostilities were renewed by one or the other and continued until we were out of sight. The species was not seen elsewhere. It is not contained in McKay's collection.

Accipiter atricapillus striatulus Ridgw. Western Goshawk.

A goshawk was seen soaring over the mountains about Iliamna Pass July 13, and several immature birds were seen daily near camp at the mouth of the Chulitna River August 4 to 8. No others were observed until we reached Nushagak, where on two or three occasions several were seen flying over a piece of swampy tundra.

Archibuteo lagopus sanctijohannis (Gmel.). Rough-legged Hawk.

A pair and two young able to fly were found in possession of an islet near the middle of Lake Clark. One of the young attempted to fly to the mainland about a mile away, but, becoming exhausted, fell into the water near the shore and was killed with a paddle. One adult was seen at the mouth of the Chulitna River August 2, and another was killed a few days later on the upper river. On the Nushagak side we saw but one. This came screaming over the boat on the lower Nushagak about September 8. One was taken on the Aleknagik or Wood River by McKay August 25, 1881.

Aquila chrysaëtos (Linn.). Golden Eagle.

According to the record of the National Museum Catalogue, a golden eagle was taken by McKay at Nushagak September 30, 1882. I have looked through the collection with considerable care, but have been unable to find this specimen.

Haliæetus leucocephalus alascanus Towns. Northern Bald Eagle.

In the course of our entire trip but five eagles were seen, as follows: At Iliamna village July 15; near the head of Lake Clark July 28; at Swan Lake August 27; on the Malchatna River September 3, and on Becharof Lake October 6. The natives report them as occurring sparingly all through the region. Their primaries and rectrices are used by the natives for vanes on arrows, and a neat little pocket needle case is made from the large part of the quill by merely cutting it off and fitting a bone or wooden plug in the open end.

Falco rusticolus gyrfalco (Linn.). Gyrfalcon.

Several falcons, presumably this species, were seen flying about a high volcanic cliff on Becharof Lake October 4. An unsuccessful shot sent them screaming away and they were not seen again. Specimens were taken at Nushagak and at Ugashik by McKay.

Falco columbarius Linn. Pigeon Hawk.

One was taken and another seen on the Nogheling River about halfway between Lakes Iliamna and Clark July 19. Several were seen flying over or unsteadily balancing on the topmost twig of some tall spruce along the Chulitna River. A second specimen was taken at the forks of the upper river August 17. The species was also seen occasionally along the Kakhtul and Nushagak rivers. Specimens were secured at Nushagak and Aleknagik Lake by McKay.

Pandion haliaëtus carolinensis (Gmel.). Osprey.

Ospreys were found quite commonly on nearly all the river courses we traversed. Fish are plentiful throughout the region, and the birds doubtless find an easy living. The first was seen soaring over the Nogheling River July 21. The next day a nest was seen in the top of a spruce on the bank of the same stream. Ospreys were seen at intervals along the Chulitna River and nearly always in the vicinity of their nests, which are bulky, flat-topped affairs, invariably located on the very top of a live spruce near the river bank, thus being very conspicuous. In several places along the Chulitna the young ospreys were seen perched on the edge of the nest. A few ospreys were seen along the Kakhtul River. One pair had a nest about half a mile from one of our camps on the Kakhtul. The old birds made one or two trips over us every day, maneuvering about in the air above the tent, dangling their legs characteristically and crying loudly or whistling shrilly.

Asio accipitrinus (Pall.). Short-eared Owl.

The short-eared owl, as well as most other species of the coast region, was met some 25 miles above Nushagak, and was seen in considerable numbers. It was attracted by the light in the tent at night and came about several of our camps near the mouth of the Nushagak River and on Becharof Lake. Several were seen flying over the houses at twilight in the villages of Nushagak and Igagik. Numerous specimens were taken by McKay and Johnson at and near Nushagak and at Ugashik.

Cryptoglaux tengmalmi richardsoni (Bonap.). Richardson Owl.

The catalogue of the National Museum records one specimen of Richardson owl, taken at Nushagak by J. W. Johnson February 20, 1884. I have been unable to find this specimen in the Museum, but since the occurrence of the species in the region is altogether probable, and since most of the names entered in the catalogue are correct, the record may be accepted.

Bubo virginianus algistus (Oberh.). Great Horned Owl.

Horned owls are only fairly common in the region traversed. One was heard at Iliamna village July 14, another at the mouth of the Chulitna River August 6, and a third on the lower Kakhtul River September 1. A specimen in immature plumage was taken at the forks of the upper Chulitna River August 16. While this specimen was being prepared, our native guide asked that the body be saved for him. When it was delivered to him it promptly went into the pot, and shortly after 'boiled owl' was eaten with a relish by the natives.

On being questioned about it they replied: "Eat um? Yes; eat um. Good! All same glouse." A specimen of this owl was taken by McKay near Aleknagik River August 24, 1881.

Nyctea nyctea (Linn.). Snowy Owl.

A poorly mounted snowy owl was seen in the trader's store at Nushagak. The species is said to be a regular winter visitant there, as well as at Igagik and Becharof Lake. Specimens were taken on the Malchatna River and at Lake Aleknagik by McKay.

Surnia ulula caparoch (Müll.). Hawk Owl.

An immature bird was taken in some thick woods near the head of Lake Clark July 27. One was seen giving battle to a pair of ravens at the mouth of the Chulitna River August 8. It was shot later from the top of a tall spruce, where it was resting after its exertions. A third was killed a few miles up the river on the following day. One was taken by McKay on the Aleknagik or Wood River, October 20, 1881, and four were taken by Johnson at Nushagak in November and December, 1884.

Ceryle alcyon (Linn.). Belted Kingfisher.

One was seen on the Kakhtul River August 28; another near the same place August 31, and a third flew cackling by us down the Malchatna River September 3. These were the only kingfishers observed on the entire trip.

Picoides arcticus (Swains.). Arctic Three-toed Woodpecker.

An adult male was taken on the Malchatna River by McKay, in March, 1883. It is the only specimen of this species from Alaska in the U. S. National Museum, and, as far as I can learn, there is no other record of its occurrence in the Territory.[a] During three seasons' work in various parts of Alaska I have never seen this woodpecker nor heard any report of it.

Picoides americanus fasciatus Baird. Alaska Three-toed Woodpecker.

A woodpecker was heard near Iliamna Village July 15; another near Keejik Village, on Lake Clark, July 24, and two specimens were taken near the head of Lake Clark July 29. Another was heard on the Chulitna River early in August, and this ended our experience with woodpeckers. Though conditions are everywhere favorable for them in this region, they seem to be quite rare. One specimen was taken by McKay on the Nushagak River January 10, 1882.

Sayornis saya (Bonap.). Say Phœbe.

One specimen, probably a migrant, was taken at the mouth of the Chulitna River August 6; no others were seen.

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[a] Nelson records one specimen from Fort Reliance, which is not in Alaska but in Yukon Territory. Cf. Nat. Hist. Coll. in Alaska, p. 157, 1887.

Otocoris alpestris arcticola Oberh. Alaska Horned Lark.

A small flock of 10 or 15 was seen flying about the summit of the Portage Mountain,' between the head of the Chulitna River and Swan Lake, August 19. No specimens were secured there, and the species was unfortunately not seen elsewhere.

Pica pica hudsonia (Sab.). Magpie.

A magpie was brought in by a native boy at Keejik Village, on Lake Clark, July 26, and several others were seen in the mountains near the head of the lake July 28. Magpies were not found again until Becharof Lake was reached, where one was taken October 6. A small flock was seen at Kanatak October 12. One was taken by McKay on the Malchatna River December 25, 1881, and four others on the Nushagak River December 13-27, 1881. They doubtless occur sparingly throughout the entire region.

Perisoreus canadensis fumifrons Ridgw. Alaska Jay.

As soon as we reached the timber on the interior side of Iliamna Pass, we met the jays, and from that time until we reached Nushagak we saw a good deal of them. They were perhaps most common about Lake Clark, but were frequently seen along the Chulitna River and on the divide, and thence to Nushagak. They frequently came about our camps, but never attempted any great familiarity. Sometimes they picked up scraps of meat near the tent, but were usually very cautious about it, at least while we were in the vicinity. They generally preferred to sit a few rods away in a spruce and entertain us by practicing some of their vocal accomplishments, which are not a few, and well warrant their being given the title of 'Mockingbird of the North.' Specimens were taken at Iliamna Village, at Lake Clark, and on the Kakhtul River. They were also taken in small numbers at Nushagak by McKay and Johnson.

Corvus corax principalis Ridgw. Northern Raven.

A small party of ravens were about camp at the mouth of the Chulitna River and kept it well cleaned of bits of meat and refuse. The raven's ability to appear from space and discover a cubic inch of decaying meat in a secret place seems second only to that of the bluebottle fly and the turkey buzzard. The birds were among the first to be active in the morning, and many times awakened us when it was scarcely dawn by the peculiar whizzing sound made by their wings as they flew slowly back and forth over the tent. Ravens were more or less common all along the route. Several were seen along the Koghiling River July 21; scattering pairs and small flocks were seen or heard at various points about Lake Clark; others now and then attracted our attention as we went down the Kakhtul and the Nushagak. They were common at Nushagak and at Igagik. Large flocks were seen at Kanatak, doubtless attracted by the carcass of a right whale which had drifted ashore near there. A few were seen at Cold Bay.

Nucifraga columbiana (Wils.). Clarke Nutcracker.

A fine specimen of the Clarke nutcracker was taken by J. W. Johnson at Nushagak November 5, 1885. This, I believe, is the second specimen of this species known to have been taken in northern Alaska.[a]

Euphagus carolinus (Müll.). Rusty Blackbird.

One specimen was taken in a willow thicket near Keejik Village, Lake Clark, July 24; no others were seen in this vicinity. They were next found along a small creek near the headwaters of the Chulitna River, where they were quite common for a few miles. Several were seen about the deserted huts of the native village of Ikwok, on the Nushagak River, September 5. McKay took one specimen on the Nushagak River and two at Lake Aleknagik.

Pinicola enucleator alascensis Ridgw. Alaska Pine Grosbeak.

Pine grosbeaks were collected by McKay near Nushagak, near Lake Aleknagik, and on the Nushagak River. Among these was the type of *P. e. alascensis* (No. 86510, U.S.N.M.), taken June 9, 1881, in spruce woods 6 miles above Nushagak. No pine grosbeaks were seen by our party.

Loxia leucoptera Gmel. White-winged Crossbill.

Crossbills were seen in much less numbers than I have usually found them elsewhere in Alaska. A few small flocks were seen at a distance about Lakes Iliamna and Clark, but they were not noted elsewhere. A single adult female was taken in January, 1883, on the Malchatna River, by McKay.

Leucosticte tephrocotis griseonucha (Brandt). Aleutian Leucosticte.

One adult male, doubtless a straggler from the Alaska Peninsula, was taken at Nushagak by McKay, November 1, 1882. It is intermediate in size between *L. griseonucha* and *L. littoralis*, being similar to some specimens from Kodiak Island.

Acanthis hornemanni exilipes (Coues). Hoary Redpoll.

Flocks were seen in September at Nushagak and along the lower Nushagak River; also found commonly about Becharof Lake and at Kanatak and Cold Bay, October 1-26. Several specimens were taken on Becharof Lake and at Cold Bay. June and July specimens in breeding plumage, taken at Nushagak by McKay and Johnson, are in the National Museum, and afford a good example of the residence of arctic birds at this point.

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[a] Cf. Ridgway, Man. N. Am. Birds, p. 364, 1887; Grinnell, Birds Kotzebue Sound, Pac. Coast Avifauna No. 1, p. 77, 1900.

In the fall, after most of the other small birds are gone, the little redpolls are more conspicuous, and many a long tramp in a dreary region is relieved of some of its monotony by their cheerful appearance at frequent intervals. They are intensely gregarious, seeming to have no individuality whatever. One even recalls their notes collectively as a medley of clicking and chipping, not musical but agreeable nevertheless. After the alders have shed their leaves the redpolls frequent them a great deal. They alight in small clouds in these thickets, swerving suddenly from their course as if one and all had suddenly changed their minds, or as if shying from a fancied danger, and in a flash they disappear in the bushes and immediately begin feeding in matter-of-fact fashion on the pendent aments. When startled they fly out hurriedly in all directions, chipping excitedly. When flying high they undulate and utter a 'cheep' much after the manner of siskins and goldfinches.

Acanthis linaria (Linn.). Redpoll.

Redpolls were common in the timbered regions about lakes Iliamna and Clark and along the Chulitna River. One was taken at Iliamna Village, July 13, and another on Lake Clark, July 23, both of which were adult males referable to typical *linaria*. Among a number of redpolls taken at Nushagak by McKay and Johnson is one (No. 86526 U.S.N.M.) which seems also to be true *linaria*. It was collected June 21, 1881, and is in very much abraded plumage.

Acanthis linaria holbœlli (Brehm). Holbœll Redpoll.

Taken at Nushagak by McKay and Johnson. Four June and July birds which have been examined are quite characteristic of this form. It was not recognized among the numbers of *A. exilipes*, seen by us at Nushagak in September. Nushagak is perhaps near the southern limit of its breeding range.

Spinus pinus (Wils.). Pine Siskin.

One was taken at Iliamna Village, July 13, and a few others seen. Several were seen on the Nogheling River, July 21. They were not seen later, and no specimens are mentioned as taken by McKay at Nushagak.

Passerina nivalis (Linn.). Snowflake.

One specimen was taken on the beach at Nushagak, September 20, and another was seen in company with it. A small flock was seen on Becharof Lake, October 6, and a few more were seen in the mountains between Becharof Lake and Kanatak. Numerous specimens were taken at Nushagak by McKay and Johnson. Most of these are winter birds, but at least one (No. 110128) is in full nuptial plumage. It was taken July 3, 1886, which would indicate its breeding in the vicinity.

It also breeds at Cold Bay, where Maddren found it nesting in high rocky cliffs in the summer of 1903.

Passerina hyperborea (Ridgw.). Hyperborean Snowflake.

The bird used as the basis for the original description of the female in winter plumage of this species was taken by McKay at Nushagak, November 16, 1882. A male bird was taken by him at the same locality, December 10, 1882. The species is evidently a regular winter visitant to this locality, for Johnson took two specimens November 12, 1884, and March 13, 1885, respectively.

Calcarius lapponicus alascensis Ridgw. Alaska Longspur.

Longspurs were first found in numbers in the coast region on the lower Nushagak River, though a few high-flying birds supposed to be this species were seen in the mountains along the Kakhtul River, September 3. They were practically the only small land birds to be found in the tundra about Bristol Bay during middle and later September. They were not in large flocks, but in parties of 10 to 20, or very frequently in twos and threes. When flushed, they usually rose up against the strong wind that was blowing most of the time and swung around with it, and in a few long sweeps alighted within a short distance. When the vegetation is dead and browned in the fall, their changed plumage makes them very inconspicuous birds. They were seen daily at Nushagak, at Igagik, along the Ugaguk River, and at various points along Becharof Lake. A few were seen at Kanatak and several at Cold Bay as late as October 25. Numerous specimens were taken at Nushagak by McKay and Johnson.

Passerculus sandwichensis alaudinus (Bonap.). Western Savanna Sparrow.

Breeding abundantly on the treeless slopes and in the small grassy mountain valleys on the west side of Iliamna Pass, where one specimen was taken July 12. Seen in small numbers in open places in the vicinity of Iliamna Village and along the Nogheling River. None were seen about Lake Clark until August 7, when they suddenly appeared in considerable numbers near the mouth of the Chulitna River, not in the open swamps, but in scattering twos and threes in the thick willow brush, evidently preparing for migration. After this date none were seen. McKay and Johnson found the species breeding at Nushagak.

Zonotrichia leucophrys gambeli (Nutt.). Intermediate Sparrow.

First seen on the portage between Lakes Iliamna and Clark, where it was found in company with *Z. coronata* July 18. Scattered individuals were observed later about Lake Clark and along the Chulitna River. One specimen was taken and a few others were seen near

Swan River August 27. They were quite rare at this time, and the majority that breed in the region had doubtless migrated. One specimen was taken at Nushagak as late as September 18. Specimens were also taken at this locality by McKay, June 6 to August 9, 1881.

Zonotrichia coronata (Pall.). Golden-crowned Sparrow.

The golden-crowned sparrow was the first land bird seen when we reached Iliamna Bay. It was very common in the low brush on the steep mountain sides about the bay, where M. W. Gorman found several nests in the latter part of June. These, he says, usually contained four eggs, though one with six was found. The bird was abundant at Iliamna village and between there and the bay. Large streaked young were found on Lake Iliamna July 17, and a few were seen about Lake Clark, which is probably as far as the species ranges into the interior. The birds are rather erratic about going south in the fall and do not all leave at once, as straggling individuals remain until quite late. One of these stragglers was taken by Johnson at Nushagak as late as November 5. Breeding birds were also taken there by McKay in June.

Spizella monticola ochracea Brewst. Western Tree Sparrow.

Several were seen on Iliamna Lake July 16 near the Nogheling portage, where one specimen was taken. A few were seen about Lake Clark, and a specimen was taken at the mouth of the Chulitna River August 3. On the trip up the Chulitna, tree sparrows were found to be quite common, being the characteristic birds of the low brush and almost the only small birds that were regularly seen each day. They were also common about the Chulitna portage and from there on down the Swan River and the Kakhtul to the Malchatna, after which they were seen no more. McKay secured specimens at Nushagak and on the Nushagak River 80 miles above its mouth.

Junco hyemalis (Linn.). Slate-colored Junco.

Up to the second week in August juncos were seen almost daily from Iliamna village to the lower Chulitna River. They were in scattered family parties, the older members of which took particular pains to follow us through the woods whenever occasion offered, persistently scolding and flitting excitedly about, making more disturbance than many other birds would at the invasion of their nests. Like the chickadees, they were particularly responsive to 'squeaks,' and seldom failed to appear promptly when calls were given for more desirable species. Several specimens were taken. They were not taken at Nushagak by McKay and Johnson. Perhaps they do not occur farther west than the Iliamna region, though it would be strange if they did not range throughout the spruce timber.

Passerella iliaca (Merrem). Fox Sparrow.

A specimen of typical *Passerella iliaca* (No. 86535 U. S. N. M.) in breeding plumage was taken by McKay at Nushagak June 6, 1881. From this it would seem that the species breeds all along the coast of Bering Sea, north of the Alaska Peninsula, since it is known to be a common breeder at St. Michael. A specimen (No. 110105) collected by J. W. Johnson at an unknown locality on the Alaska Peninsula is intermediate in character between *iliaca* and *unalaschcensis*, but nearer to *iliaca.*

Passerella unalaschcensis (Gmel.). Peninsula Sparrow.

One specimen was taken and several were seen in the mountains near Iliamna Bay July 12; two others, one adult and one immature bird, were taken at Iliamna village July 14; and another young bird was taken on Lake Iliamna at the Nogheling portage July 18. These agree well with birds from the Shumagin Islands and localities to the westward on the Alaska Peninsula. Doubtless these localities are near the eastern limit of the range of typical *unalaschcensis*, since aberrant birds are found in Cook Inlet.[a] The young are easily distinguishable from young of *insularis* and *annectens* by much the same characters as the adults. They are generally grayer and less rufescent and the light-creamy areas on the under parts are more extensive. On the upper-parts the head, neck, and forepart of the back are grayer, and show greater contrast with the rump and upper tail-coverts.

A specimen of typical *unalaschcensis* in fresh fall plumage was taken at Nushagak September 19; another, which is not quite typical, but easily referable to *unalaschcensis*, was taken at the same locality by J. W. Johnson October 22, 1884. These birds may have been wanderers, but if so they must have wandered out of their regular course of migration and traveled in a northerly or westerly direction for a considerable distance, as their known breeding range is to the south and east. Nushagak, where typical *iliaca* breeds, is scarcely 100 miles from Lake Iliamna and points on the Alaska Peninsula where we have typical *unalaschcensis*. Between these localities there is no physical barrier and no appreciable difference in temperature or environment. If we assume that intergradation takes place between these two birds in this short distance, we must do it merely on the evidence of a very limited number of specimens showing a combination of characters. Without apparent environmental cause it hardly seems possible that differentiation takes place in such a short distance between two such well-marked forms; one a distinctly rufescent bird, the other as distinctly olivaceous gray; one with bright chestnut primaries and rectrices, the other with these parts of quite different color; one a bird with white wing-bars, the other with none; one with ack striped, the other with back plain. If it be true that gradual ntergradation according to a sequence of geographical units does ake place in this case, it is certainly the most remarkable on record. f we consider the few intermediate specimens as hybrids pure and imple, there is much less to be explained. Additional specimens from ifferent parts of the Alaska Peninsula would perhaps decide the question, but while it is necessary to choose from hypotheses, I prefer he hybrid theory to that of gradual geographic intergradation. In his connection it is interesting to note that most of the supposed intergrades' are winter birds from California and that no typical *liaca* has been taken in California.[a] Accepting the hybrid theory, it s possible to believe that these birds were led to take a western route, hile typical *iliaca*, although breeding in practically the same region, as invariably followed its own route to the eastward.

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[a] Cf. N. Am. Fauna No. 21, p. 79, 1901.

irundo erythrogastra Bodd. Barn Swallow.

Barn swallows breed commonly in the vicinity of Lake Iliamna and ake Clark, where we found them in late July and early August. t is probable that they are also summer residents of much of the other ountry through which we traveled, but we arrived too late to find hem. They were seen in small numbers at Iliamna Village July 14; n Lake Iliamna July 15; about the islands in Lake Clark July 23; and near the mouth of the Chulitna River August 6 to 10. They appeared with other swallows in considerable numbers August 6, and soared about all day. The majority of them disappeared the next day (August 7), and by August 10 practically all were gone.

Iridoprocne bicolor (Vieill.). Tree Swallow.

A few unmistakable tree swallows were seen in company with flocks of violet-green swallows at Iliamna Village July 13 to 15. They were not recognized with certainty elsewhere.

Tachycineta thalassina lepida (Mearns). Northern Violet-green Swallow.

Violet-green swallows were found in considerable numbers at Iliamna Village and several specimens were taken July 13 to 15. At this time they were flying actively as late in the evening as 9.30. Earlier in he season they doubtless fly much later. Small numbers were seen n Lakes Iliamna and Clark. On August 6 they were preparing to migrate. None were seen after August 10, when I left the mouth of he Chulitna River.

iparia riparia (Linn.). Bank Swallow.

No signs of bank swallows were seen except along a short stretch of he Nushagak River between the mouth of the Tikchik and Kakwok, here most of the high banks were drilled along the upper edges with their characteristic holes. The birds themselves were not seen, doubtless having migrated early in August. Summer specimens taken at Nushagak by McKay are in the National Museum.

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[a] I believe I am correct in this. *P. iliaca* has been variously recorded from California, but so far as I know the specimens are of the hybrid type.

Lanius borealis Vieill. Northern Shrike.

An immature bird was taken at the mouth of the Chulitna River August 5, and another at Swan Lake August 25. One was seen on the Kakhtul River August 31. Another, the last one seen, was found near Nushagak September 17. Two specimens were taken by McKay at Ugashik September 20, 1881.

Helminthophila celata (Say). Orange-crowned Warbler.

A few scattering birds were seen in the low bushes about Lakes Iliamna and Clark in July. One specimen was taken at Iliamna Village July 14, and another, an immature bird, near the head of Lake Clark July 26. The species doubtless went south with the other warblers soon after the 1st of August, as we saw none after that date. The immature example differs quite decidedly from the adult, in having two buffy wing bars, buffy sides, grayish head and throat, a decided whitish loral stripe, and a grayish brown pileum and nape distinct from olivaceous back. The species breeds in the vicinity of Nushagak, as testified by several specimens taken in June by McKay.

Dendroica æstiva rubiginosa (Pall.). Alaska Yellow Warbler.

The yellow warbler was one of the least common of the warblers seen about Lake Iliamna and Lake Clark during the early part of our trip. One specimen was taken at Iliamna Village July 15, and another about 10 miles above the mouth of the Chulitna River August 11. Several others were seen or heard near Iliamna Village and about Lake Clark. Specimens were taken at Nushagak by McKay and Johnson.

Dendroica coronata (Linn.). Myrtle Warbler.

The myrtle warbler was found in considerable numbers about Lake Clark, where it doubtless breeds. It was most abundant August 6, when a slight migrating wave was observed at the mouth of the Chulitna River. Several specimens were taken, including both adults and young of the year. The species was collected at Nushagak by McKay.

Dendroica striata (Forster). Black-poll Warbler.

This was the most common of the warblers seen from July 14 to August 12. It was fairly common at Iliamna Village; a few were seen along the Nogheling River, and many at various points along Lake Clark. They frequented the tops of the deciduous trees more than the other warblers, which generally kept lower down in the willow brush. Our camp at the mouth of the Chulitna River was situated in a grove of birch and poplar. From August 6 to August 10 it was possible to step outside the tent at almost any time during the day and see one or more black-polls flitting through the tree-tops. Of the seven specimens taken nearly all are young in transition plumage. One taken on Lake Clark July 23 is irregularly patched with parts of the juvenal and the first fall plumages. The light olivaceous of the new plumage is appearing strongly on the pileum, breast, and sides, and a few new feathers are scattered through the scapular tracts. Elsewhere is the more or less mottled dusky and creamy of the juvenal plumage. The species undoubtedly breeds throughout the timbered region traversed by us. McKay's collection contains two breeding birds, one taken on the Nushagak River, 80 miles above its mouth, June 25, 1881, and one at Aleknagik Lake June 17, 1881.

Seiurus noveboracensis notabilis Ridgw. Grinnell Water Thrush.

A pair of water thrushes was seen at Iliamna Village July 14. They flew nervously about in a willow thicket, and acted as if a brood of young might be secreted in the vicinity. No more were seen until August 3, when they became quite common at the mouth of the Chulitna River, where they were beginning to migrate. Their quick, nervous actions and decisive call note made them very noticeable. Three specimens were taken there, one of them being caught in a mouse trap under a decayed log in a boggy place. None were seen later than August 7. One specimen was taken by McKay on the Nushagak River, 85 miles above its mouth, June 6, 1881.

Wilsonia pusilla pileolata (Pallas). Pileolated Warbler.

Pileolated warblers were found in abundance among the thickets of alder and willow from the summit of Iliamna Pass to Iliamna Village. They were found about Lake Clark and were particularly numerous among other migrating warblers at the mouth of the Chulitna River August 5 to 7, perhaps being second in abundance only to the blackpoll warbler. They were found in low brush, particularly willow, rather than higher up in birches and spruce, where other species preferred to be. Specimens were taken at Iliamna Pass, Iliamna Village, head of Lake Clark, and at the mouth of the Chulitna River. In 1881 McKay took four specimens at Nushagak.

Budytes flavus alascensis Ridgw. Alaska Yellow Wagtail.

McKay and Johnson secured four breeding birds of this species in June and July at Nushagak. This is doubtless near the southern limit of its breeding range on this continent.

Anthus pensilvanicus (Lath.). Pipit.

A few small flocks were seen in barren rocky places about the tops of some low mountains near the Kakhtul River August 29-31. McKay secured two specimens at Nushagak August 25, 1881.

Cinclus mexicanus Swains. Dipper.

One adult was taken at the mouth of a cold rushing stream near the head of Lake Clark August 1. It was accompanied by a young bird, able to fly but not lacking in juvenile manners. The parent skipped about the rocks or dove unconcernedly into the icy riffles. Meanwhile the young one, with feathers ruffled and head thrown slightly back, fluttered about, making frequent stops, while it kept up a plaintive cry, accompanied by a fretful expression about all its movements which reminded me of a wilful child. These were the only ouzels met with until near the end of our trip, when a specimen was taken on a small mountain stream at Cold Bay October 18. McKay took five specimens on the Malchatna River December 15–20, 1881.

Parus atricapillus turneri Ridgw. Turner Chickadee.

Chickadees were found sparingly all along our route. Toward the end of the season they shared places in our affections with the redpolls, as most of the other small land birds had migrated. Specimens were taken on Lake Clark, on the Nushagak River, at Nushagak, and at Cold Bay. Specimens from Nushagak, taken by McKay and Johnson, are also in the National Museum. These, as well as others from Alaska, seem to indicate that *Parus atricapillus turneri* merits recognition as a form subspecifically different from *P. a. septentrionalis*. The Alaska bird contrasted with *P. a. septentrionalis* is characterized by a decidedly smaller and more slender bill, shorter wing and tail, and general grayer coloration. The black of the pileum is more dead bluish-black, without any brownish cast as in *septentrionalis;* the white on the outer webs of the secondaries is broader and more extensive; and on the outer web of the outer rectrix there is less tendency to a dusky wedge next to the shaft. In fall plumage particularly there is less buffy tingeing on the back and rump, as well as on the sides, than is the case with *septentrionalis.*

Parus hudsonicus Forst. Hudsonian Chickadee.

The Hudsonian chickadee was much less common than I have usually found it elsewhere in Alaska. Only two specimens were collected, one at the head of Lake Clark, July 31, and another at Nushagak, September 19. A few small flocks were seen at other points, but at rather long intervals.

Acanthopneuste borealis (Blas.). Kennicott Willow Warbler.

Two specimens of this interesting bird were secured near Iliamna Village, July 13 and 14. They were found in small deciduous trees, where their actions were not noticeably different from those of other warblers with which they were associated. McKay's collection contains one specimen of this species taken near the Aleknagik River, August 24, 1881. Two specimens taken by J. W. Johnson, at Nushagak, June 19, 1884, are in the National Museum. Previous records include 9 specimens from Alaska—6 from Norton Sound,[a] 2 from the Kowak River,[b] and 1 from Port Clarence.[c]

Hylocichla aliciæ (Baird). Gray-cheeked Thrush.

A gray-cheeked thrush was seen at Swan Lake August 25, and another a few days later on the Kakhtul River; a third was collected near the mouth of the Kakhtul River September 1. This specimen is more olivaceous than any other I have seen, which is perhaps due to its being in newly acquired fall plumage. McKay secured two specimens, one at Aleknagik Lake and one near Nushagak.

Hylocichla ustulata swainsoni (Cab.). Olive-backed Thrush.

This thrush was heard rarely in late July in the Lake Iliamna and Lake Clark region, and not at all after we left the mouth of the Chulitna River early in August. The lateness of our arrival doubtless deprived us of the pleasure of hearing the beautiful night song of the bird, so well known to summer travelers in Alaska. One specimen was taken on Lake Clark, near Keejik, July 24.

Hylocichla guttata (Pall.). Alaska Hermit Thrush.

Two specimens taken at the head of Lake Clark July 29 were the only hermit thrushes seen. Two specimens taken at Nushagak by McKay and Johnson are recorded in the National Museum Catalogue, but I have been unable to find them.

Merula migratoria (Linn.). Robin.

A few robins were seen near Iliamna Village, and one specimen was taken there July 15. From this point on to the upper Chulitna River robins were seldom seen, though once in a great while we heard their familiar note. They were quite abundant in small flocks about Swan Lake August 25, and considerable numbers were also seen near there in the brush and young timber around the base of the 'Portage Mountain.' Specimens were taken at Nushagak by McKay in June, 1881.

Ixoreus nævius (Gmelin). Varied Thrush.

The unmistakable note of this species was heard on the Kakhtul River on the evening of August 28, and the following day, a few miles farther downstream, one of the birds was seen perched in the top of a spruce. The species was not observed elsewhere. McKay secured specimens in June on the Nushagak River near its mouth, and at Aleknagik Lake.

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[a] Dall and Bannister, Trans. Chicago Acad. Sci., I, p. 278, 1869; Baird, Ibid., p. 313; Nelson, Nat. Hist. Coll. in Alaska, pp. 214-215, 1888; McGregor, Condor, IV, p. 144, 1902.

[b] Townsend, Auk, IV, p. 13, 1887, and Cruise of Rev. Stmr. *Corwin* in 1885, p. 94, 1887; Grinnell, Birds of Kotzebue Sd., Pac. Coast Avifauna No. 1, p. 60, Nov., 1901.

[c] Townsend, Auk, loc. cit.

INDEX.

exilipes, 22, 72–73.
lli, 22, 78.
a, 73.
neuste borealis, 80.
striatulus, 68.
67.
cularia, 63–64.
as maculata, 62.
illa, 62.
semipalmata, 64.
4, 15, 20.
short-tailed, 54.

29–30.
dis, 11.
has, 55–57.
la, 21.
ibeli, 59.
nsilvanicus, 79.
irgata, 64.
rysaëtos, 68.
o sancti-johannis, 68.
, 21.
interpres, 64.
ocephala, 64.
a couesi, 62.
nemis, 62.

itrinus, 69.
rested, 52.
uet, 52.
arila, 57.
2.
di, 27.
57.
brown, 50.
k, 41.
r, 41–45.
sula brown, 41–45.
2–33.
skana, 11, 17.
lifolia, 11, 16.
arf, 11, 16.
, 11.
of, 51–81.
, rusty, 72.
mphus brevirostris, 52.
oratus, 52.
tchinsi, 59.
stus, 69–70.
lascensis, 22, 79.
d, 57.
alascensis, 22, 74.
s osgoodi, 64, 65.

Canis albus, 39–40.
Caribou, peninsula, 27–29.
Castor canadensis, 32–33.
Cepphus columba, 52.
Ceryle alcyon, 70.
Chamæcistus, 17, 21.
Charadrius fulvus, 22, 64.
Charitonetta albeola, 57.
Chickadee, Hudsonian, 80.
  Turner, 80.
Cinclus mexicanus, 80.
Circus hudsonius, 67.
Citellus, 22.
  ablusus, 31–32.
Clangula islandica, 57.
Colymbus auritus, 51.
  holbœlli, 51.
Cormorant, pelagic, 55.
  white-crested, 54–55.
Corvus principalis, 71–72.
Crane, little brown, 61.
Crossbill, white-winged, 72.
Crowberry, black, 44.
Crymophilus fulicarius, 22, 61.
Cryptoglaux richardsoni, 69.
Curlew, Hudsonian, 64.
Cyclorrhynchus psittaculus, 52
Dafila acuta, 57.
Delphinapterus, 22.
  leucas, 27.
Dendroica coronata, 78
  rubiginosa, 78.
  striata, 78–79.
Devil's club, 14.
Dicrostonyx, 22.
  nelsoni, 37.
Diomedea albatrus, 54.
Dipper, 80.
Dowitcher, 62.
Dryas, 21.
Duck, harlequin, 58.
  scaup, 57.
  Steller, 58.
Eagle, golden, 68.
  northern bald, 68.
Echinopanax, 14.
Eider, king, 58.
  Pacific, 58.
Empetrum, 19, 21.
  nigrum, 44.
Erethizon myops, 38.
Ereunetes occidentalis, 63.
Erignathus, 22.
  nauticus, 47–48.

- **Euarctos, 22.**
- **Euphagus carolinus, 72.**
- **Evotomys, 22.**
  - **dawsoni, 33–34.**
- **Falco columbarius, 68–69.**
  - **gyrfalco, 68.**
- **Fiber spatulatus, 35.**
- **Fox, Alaska red, 40.**
  - **arctic, 22.**
  - **continental arctic, 40.**
- **Fratercula corniculata, 52.**
- **Gallinago delicata, 62.**
- **Gavia adamsi, 51.**
  - **lumme, 51–52.**
  - **pacifica, 51.**
- **Godwit, marbled, 63.**
- **Golden-eye, Barrow, 57.**
- **Goose, emperor, 59–60.**
  - **Hutchins, 59.**
  - **white-fronted, 59.**
- **Goshawk, western, 68.**
- **Grebe, Holbœll, 51.**
  - **horned, 51.**
- **Grosbeak, Alaska pine, 72.**
- **Grouse, Alaska spruce, 64–65.**
- **Grus canadensis, 61.**
- **Guillemot, pigeon, 52.**
- **Gull, Bonaparte, 54.**
  - **glaucous-winged, 53.**
  - **Sabine, 54.**
  - **short-billed, 53–54.**
- **Gulo, 22.**
  - **luscus, 46–47.**
- **Gyrfalcon, 68.**
- **Haliæetus alascanus, 68.**
- **Hare, Alaska arctic, 39.**
  - **arctic, 22.**
  - **Dall varying, 39.**
- **Harelda hyemalis, 58,**
- **Hawk, marsh, 67.**
  - **pigeon, 68–69.**
  - **rough-legged, 68.**
  - **sharp-shinned, 67.**
- **Helminthophila celata, 78.**
- **Hirundo erythrogastra, 77.**
- **Histrionicus histrionicus, 58.**
- **Hylocichla aliciæ, 81.**
  - **guttata, 81.**
  - **swainsoni, 81.**
- **Iridoprocne bicolor, 77.**
- **Ixoreus nævius, 81.**
- **Jaeger, long-tailed, 52.**
  - **parasitic, 52.**
- **Jay, Alaska, 71.**
- **Junco hyemalis, 75.**
- **Junco, slate-colored, 75.**
- **Kingfisher, belted, 70.**
- **Kittiwake, Pacific, 53.**
- **Lagopus lagopus, 22, 65–66.**
  - **leucurus, 67.**
  - **nelsoni, 66–67.**
- **Lanius borealis, 78.**
- **Lark, Alaska horned, 71,**
- **Larus brachyrhynchus, 53–54.**
  - **glaucescens, 53.**
  - ***philadelphia*, 54.**
- ***Latax lutris, 47.***
- **Lemming, Nelson pied, 37.**
  - **pied, 22.**
- **Lemmus minusculus, 36–37.**
- **Lepus dalli, 39.**
  - **othus, 22, 39.**
- **Leucosticte griseonucha, 72.**
  - **Aleutian, 72.**
- **Life zones, 21–25.**
- **Limosa fedoa, 63.**
- **Longspur, Alaska, 74.**
- **Loon, Pacific, 51.**
  - **red-throated, 51–52.**
  - **yellow-billed, 51.**
- **Loxia leucoptera, 72.**
- **Lunda cirrhata, 52.**
- **Lutra, 22.**
  - **canadensis, 45.**
- **Lutreola melampeplus, 45–46.**
- **Lynx, Canada, 39,**
- **Lynx canadensis, 39.**
- **Macrorhamphus griseus, 62.**
- **Magpie, 71.**
- **Mallard, 55–57.**
- **Mammals, list of, 27–50.**
- **Mareca americana, 57.**
- **Marmot, hoary, 32.**
- **Marmota caligata, 32.**
- **Marten, 46.**
- **Merganser americanus, 55.**
  - **serrator, 55.**
- **Merganser, 55.**
  - **red-breasted, 55.**
- **Merula migratoria, 81.**
- **Microsorex, northern, 50.**
- **Microtus, 22.**
  - **drummondi, 35.**
  - **kadiacensis, 34–35.**
- **Mink, Kenai, 45–46.**
- **Moose, Alaska, 29–30.**
- **Mouse, Dall lemming, 35–36.**
  - **Dawson red-backed, 33–34.**
  - **Hudson Bay jumping, 37–38.**
- **Murre, California, 52.**
- **Murrelet, Kittlitz, 52.**
  - **marbled, 52.**
- **Mus norvegicus, 33.**
- **Muskrat, northwest, 35.**
- **Mustela, 22.**
  - **americana, 46.**
- **Myotis lucifugus, 50.**
- **Nettion carolinense, 57.**
- **Nucifraga columbiana, 72.**
- **Numenius hudsonicus, 64.**
- **Nutcracker, Clarke, 72.**
- **Nyctea nyctea, 70.**
- **Nymphæa, 11.**
- **Oceanodroma furcata, 54.**
  - **leucorhoa, 54.**
- **Ochotona collaris, 38.**
- **Odobenus, 22.**
  - **obesus, 49.**
- **Oidemia americana, 58–59.**
  - **deglandi, 59.**
  - **perspicillata, 59.**
- **Oldsquaw, 58.**
- **Olor columbianus, 60–61.**
- **Osprey, 69**

icola, 71.
5.

sis, 30.
orned, 69–70.

on, 69.
ed, 69.
).
olinensis, 69.
icus, 80.
0.
laudinus, 74.
aca, 76.
censis, 76–77.
perborea, 25, 74.
2, 73–74.
alina, 62.
mifrons, 71.
ailed, 54.
.
x cincinatus, 54–55.
, 55.
orthern, 61.

obatus, 61.
agica, 59–60.
di, 48–49.
ocæna, 27.
70.
a, 71.
ensis, 11, 13, 15.
13.
icus, 70.
, 70.
d, 38.
censis, 72.

ic golden, 64.
nated, 64.
elleri, 22, 58.
amifera, 10, 13–14, 17.
des, 13, 17.
laska, 38.
bor, 27.
elson, 66–67.
led, 67.
d, 52.
2.
irostris, 54.

46.

–29.
, 33.
ern, 71–72.
ry, 72–73.
73.
ria, 77–78.
ris, 53.

leutian, 62.

62.

Sandpiper, Pribilof, 62.
  red-backed, 62.
  spotted, 63–64.
  western, 63.
Sayornis saya, 70.
Sciurus, 22.
  hudsonicus, 30–31.
Scoter, 58–59.
  surf, 59.
  white-winged, 59.
Seal, Pacific harbor, 48–49.
  western bearded, 47–48.
Seiurus notabilis, 79.
Shearwater, slender-billed, 54.
Sheep, Kenai, 30.
Shoveller, 57.
Shrew, arctic, 49–50.
  Shumagin, 50.
Shrike, northern, 78.
Simorhynchus cristatellus, 52.
Siskin, pine, 73.
Snipe, Wilson, 62.
Snowflake, 25, 73–74.
  hyperborean, 74.
Somateria spectabilis, 22, 58.
  v-nigra, 22, 58.
Sorex, 22.
  arcticus, 49–50.
  eximius, 50.
  shumaginensis, 50.
Sparrow, fox, 76.
  golden-crowned, 75.
  intermediate, 74–75.
  peninsula, 76–77.
  western savanna, 74.
  western tree, 75.
Spatula clypeata, 57.
Spinus pinus, 73.
Spizella ochracea, 75.
Spruce, black, 13.
  white, 11, 13, 15.
Squatarola squatarola, 22, 64.
Squirrel, Hudson Bay red, 30–31.
  Nushagak ground, 31–32.
Stercorarius longicaudus, 52.
  parasiticus, 22, 52.
Sterna paradisæa, 54.
Surf bird, 64.
Surnia caparoch, 70.
Swallow, bank, 77–78.
  barn, 77.
  northern violet-green, 77.
  tree, 77.
Swan, whistling, 60–61.
Synaptomys, 22.
  dalli, 35–36.
Tachycineta lepida, 77.
Teal, green-winged, 57.
Tern, arctic, 54.
Thrush, Alaska hermit, 81.
  gray-cheeked, 81.
  Grinnell, water, 79.
  olive-backed, 81.
  varied, 81.
Totanus melanoleucus, 63.
Turnstone, 64.
  black, 64.

Uria californica, 52.
Ursus, 22.
    americanus, 41.
    gyas, 41–45.
    kidderi, 41–45.
Vaccinium, 17, 21, 44.
Vole, Drummond, 35.
    Kodiak, 34–35.
Vulpes alascensis, 40.
    innuitus, 40.
    lagopus, 22.
Wagtail, Alaska yellow, 79.
Walrus, Pacific, 49.
Warbler, Alaska yellow, 78.
    black-poll, 78–79.
    Kennicott willow, 80–81.
    myrtle, 78.
Warbler, orange-crowned, 78.
    pileolated, 79.
Weasel, arctic, 46.
Whale, Pacific right, 27.
    white, 27.
Wilsonia pileolata, 79.
Wolf, northern, 39–40.
Wolverine, 46–47.
Woodpecker, Alaska three-toed, 70.
    arctic three-toed, 70.
Xema sabinei, 54.
Yellow-legs, greater, 63.
Zapus, 22.
    hudsonius, 37-38.
Zones, life, 21–25.
Zonotrichia coronata, 75.
    gambeli, 74–75.

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No. 25

[Actual date of publication, October 24, 1905]

BIOLOGICAL SURVEY OF TEXAS

LIFE ZONES, with Characteristic Species of Mammals, Birds, Reptiles, and Plants
REPTILES, with Notes on Distribution
MAMMALS, with Notes on Distribution, Habits, and Economic Importance

BY

VERNON BAILEY
CHIEF FIELD NATURALIST

Prepared under the direction of

DR. C. HART MERRIAM
CHIEF OF BIOLOGICAL SURVEY

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Biological Survey,
Washington, D. C., July 10, 1905.

Sir: I have the honor to forward herewith, for publication as North American Fauna No. 25, a report on the results of a biological survey of Texas, by Vernon Bailey. The report consists of three sections: The first characterizes the life zones and defines the distribution areas of the State; these are mapped in detail and are accompanied by practical suggestions as to their adaptation to agricultural uses. The second comprises a brief report on the snakes and lizards, adding considerably to previous knowledge of the distribution of these groups. The third consists of a report on the mammals of the State, and contains much of a practical nature on distribution, habits, and economic relations of the several species.

The maps and illustrations are essential to the clearness and brevity of the report.

C. Hart Merriam,
Chief, Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

CONTENTS.

Page.
oduction 9
Personnel of Biological Survey work in Texas 10
Acknowledgments 10
New species of mammals 10
na and flora of Texas in relation to life zones and minor distribution eas 11
Tropical element of the Lower Rio Grande region 14
Lower Austral zone 16
  Gulf Strip of Texas 16
  Austroriparian of eastern Texas 18
    Grand and Black prairies 19
    Coast prairie 19
    Coast marshes 20
    Beaches and islands 20
    Mammals of eastern Texas Austroriparian 20
    Birds breeding in eastern Texas Austroriparian 21
    A few of the lizards and snakes of eastern Texas 21
    Plants characteristic of humid eastern in distinction from arid western Texas 22
  Lower Sonoran of western Texas 23
    Semiarid Lower Sonoran 23
    Extreme arid Lower Sonoran 25
    Mammals of Lower Sonoran of western Texas 26
    Breeding birds of Lower Sonoran of western Texas 27
    Reptiles of Lower Sonoran 28
    Conspicuous plants of Lower Sonoran 29
Upper Austral zone, Upper Sonoran division 33
    Mammals of Upper Sonoran 34
    Birds of Upper Sonoran 34
    Lizards and snakes of Upper Sonoran 35
    Plants of Upper Sonoran plains 35
    Plants of Upper Sonoran mountains and foothills 35
Transition zone 36
Canadian zone 38
ort on the Biological Survey collection of lizards and snakes from Texas 38
port on the mammals of Texas 51

ILLUSTRATIONS.

PLATES.

Page.
PLATE I. Map of life zones of Texas and parts of New Mexico, Oklahoma, and Indian Territory .... Frontispiece
II. Cypress and other swamp timber near Jefferson 18
III. Map of distribution of mesquite in western Texas 24
IV. Map of distribution of red-bellied and Texan woodpeckers in eastern and western Texas 24
V. Fig. 1. *Fouquiera splendens* and *Covillea tridentata* 26
Fig. 2. Desert vegetation of Great Bend region 26
VI. *Agave lecheguilla*, near Boquillas, Great Bend of Rio Grande 32
VII. *Agave wislizeni* in flower, Davis Mountains, humming bird at flower cluster on left 32
VIII. Sotol before and after the leaves are burned off, on mesa near Comstock (photographed by Oberholser) 32
IX. Views on Staked Plains near Hereford and Dimmitt (photographed by Oberholser) 36
X. Fig. 1. Transition zone timber of Guadalupe Mountains 36
Fig. 2. Head of Dog Canyon, Guadalupe Mountains 36
XI. Transition zone timber of Chisos Mountains (photographed by Oberholser) 36
XII. Map of distribution of eastern rattlesnake and Texas diamond rattlesnake 50
XIII. Map of distribution area in Texas of the thirteen-lined ground squirrels (*Citellus texensis* and *pallidus*) 86
XIV. Map of distribution in Texas of Baird and Mexican wood rats (*Neotoma micropus* and *mexicana*) 112
XV. Head of wild-cat (*Lynx baileyi*), drawing by Fuertes 170
XVI. Civet cat, drawing by Fuertes 182

TEXT FIGURES.

Page.
IG. 1. Map of distribution area in Texas of huisache (*Vachellia farnesiana*) 17
2. Map of distribution area in Texas of creosote bush (*Covillea tridentata*) 25
3. Map of distribution area of *Agave lechequilla* 30
4. Map of distribution area of the black and yellow persimmons (*Brayodendron texanum* and *Diospyros virginiana*) 32
5. Skull of armadillo, *Tatu n. texanum*, from Brownsville, Texas 52
6. Skull of armadillo, *Tatu n. mexicanum*, from Colima, Mexico 53

Pa
FIG. 7. Map of distribution area in Texas of the armadillo
8. Map of distribution area in Texas of the peccary
9. Photograph of a gray mule deer yearling buck, at Langtry
10. Map of distribution area in Texas of the fox squirrels (*Sciurus ludovicianus* and *limitis*)
11. Map of distribution area in Texas of the gray squirrel (*Sciurus carolinensis*)
12. Map of distribution area in Texas of the flying squirrel (*Sciuropterus v. querceti*)
13. Map of distribution area in Texas of the antelope squirrel (*Ammospermophilus interpres*)
14. Map of the distribution area in Texas of the prairie dog
15. Map of distribution area in Texas of *Peromyscus taylori* and *subater*
16. Map of distribution area in Texas of white-throated wood rat (*Neotoma albigula*)
17. Map of distribution area in Texas of cotton rats of the genus *Sigmodon*
18. Photograph of cotton rat and nest in Pecos Valley
19. Photographs of large pocket mouse (*Perognathus hispidus*) caught in traps at Seguin
20. Photograph of long-eared cottontail (*Lepus a. minor*) in Pecos Valley
21. Gray fox (*Urocyon c. scotti*) photographed in trap at Langtry by Oberholser
22. Prairie-dog burrow enlarged by badger, Pecos Valley
23. Map of distribution area in Texas of the spotted skunks of the genus *Spilogale*
24. Map of distribution area in Texas of the white-backed skunks of the genus *Conepatus*

25. NORTH AMERICAN FAUNA. Oct., 1905.

BIOLOGICAL SURVEY OF TEXAS.

By VERNON BAILEY.

INTRODUCTION.

For a number of years the Biological Survey has been collecting information and specimens bearing on the natural history of Texas. Some of the results are here brought together in a discussion of the life zones and their subdivisions and a report on the mammals and reptiles of the State. The original plan included also a report on the birds of Texas by H. C. Oberholser, but the present paper has grown to such proportions that the bird report will be published separately. Much of the field work has been carried on in connection with that of adjacent regions, and on several occasions it has been possible to keep parties in the field until late in the season or throughout the winter by moving them southward into Texas in the fall, or to begin work there early in the spring before the season had opened [illegible] for operations farther north. [illegible] the Texas [illegible] the appearance of being desultory and scattered, the ge[illegible] has been covered with great care [illegible] of the field work has been [illegible] of great economic problems [illegible] several pests, and throughout all [illegible] animals has received special attention [illegible] reptiles, and plants [illegible] the extent and [illegible] detail in the field [illegible] number of specimens has been [illegible] climatic difference. Of [illegible] especially of the deer [illegible] enough material [illegible] the limits of the species [illegible] greatly [illegible] hoped that the growing interest in natural history will inspire local hunters and residents of the country to send specimens of these vanishing forms to the National Museum before it is too late. Many important problems can be solved only by aid from local naturalists or other intelligent residents of the State. The skull that is left in the woods or thrown away would often aid in solving one of these problems.

PERSONNEL OF BIOLOGICAL SURVEY WORK IN TEXAS.

In carrying on the field work in Texas the writer was assisted at different times by the following regular or temporary field naturalists of the Biological Survey: William Lloyd, Clark P. Streator, William L. Bray, Harry C. Oberholser, N. Hollister, Merritt Cary, Gordon Donald, Arthur H. Howell, and James H. Gaut.

Several local naturalists and collectors have added materially to the results of the work in Texas, and among these thanks are especially due to Mr. H. P. Attwater and Mr. Howard Lacey.

Extensive collections of mammals, birds, reptiles, batrachians, crustaceans, mollusks, and plants have been made from localities practically covering the State, and the field reports of the collectors contain a mine of important facts on habits, distribution, correlation, and economic importance of species. Much of this material has already been published by the Biological Survey in the form of bulletins and papers on economic subjects, and much still remains for use in future papers.

ACKNOWLEDGMENTS.

To Dr. C. Hart Merriam, under whose direction the work was planned and carried out, I am indebted for the use of his private collection of mammals deposited in the United States National Museum. To Mr. F. W. True, curator, and Mr. Gerrit S. Miller, jr., assistant curator of mammals in the National Museum, I am indebted for the use of the museum collection; also to Dr. J. A. Allen, curator of birds and mammals in the American Museum of Natural History; Mr. Outram Bangs, curator of mammals in the Museum of Comparative Anatomy; and Mr. Witmer Stone, curator of birds and mammals in the Philadelphia Academy of Sciences, for the loan of types and topotypes of mammals from the collections under their supervision

NEW SPECIES OF MAMMALS.

A number of new species of plants, reptiles, birds, and mammals has been found in the Texas collection. Most of these have been described and named by various specialists, but descriptions of a [illegible] previously undescribed mammals are included in the present report. They are as follows:

	Page
Tatu novemcinctum texanum	52
[illegible]	99
[illegible] taylori subater	102
[illegible]	106
Castor canadensis texensis	122
[illegible] llanensis	129
[illegible]	159
[illegible] texensis	175
[illegible]	203

FAUNA AND FLORA OF TEXAS IN RELATION TO LIFE ZONES AND MINOR DISTRIBUTION AREAS.

The fauna and flora of Texas are wonderfully rich and varied, not only in abundance of individuals and species, but in the number of genera, families, and orders, some of which do not occur in any other part of the United States. This richness is due, not so much to the enormous extent of the State, as to its varied physical and climatic conditions, for it embraces areas of abundant humidity and extreme aridity, of dense forest and extensive plain, of low coast prairie and [illegible] mountains. Besides stretching across the aerial paths of north and south migrating birds and bats, it lies at the threshold of the Tropics and claims a large contingent of Mexican species. On the east it includes the fauna and flora of the lower Mississippi Valley, with most of the species ranging to the Atlantic coast, and on the west reaches far into the desert region of highly specialized forms, while [illegible] the middle portion it is traversed by a wide [illegible] the northern fauna and flora of the Great Plains. [illegible] mountain masses reach an altitude of [illegible] feet, [illegible] 8,500 and 9,500 feet. The range of [illegible] the great extent of latitude, suffice to [illegible] the State [illegible] of three of the principal life zones [illegible] Austral and Transition, each with [illegible] and animals. In the Lower Rio Grande [illegible] however, a slight overlapping of tropical [illegible] the almost tropical climate, which [illegible] mountains are [illegible]

The agricultural and commer[illegible] State [illegible] climatic conditions [illegible] mapped they are found [illegible] area of distribution of certain [illegible] In other words, various [illegible] developed by endless and costly experiment along the [illegible] the native species have [illegible] environment. Thus the [illegible] of the State [illegible] scribed by the distribution of certain species of trees. On the other hand, successful stock raising depends in part on the absence of forests and the abundance of certain grasses, and in part on the absence of certain disease-conveying parasites. Several varieties of wheat are successfully raised over a limited area near the upper edge of humid Lower Sonoran zone, but most of the State lies below the belt of small grains. Rice and sugar cane are standard crops of the semitropical coast region, and cotton is the staple for the whole Lower Sonoran zone, wherever the rainfall is sufficient to mature the crop or water is available for irrigation. Parts of the State are peculiarly adapted to the production of early fruits and winter vegetables for the northern market, but these industries are as yet more or less restricted by inadequate facilities for quick transportation.

The division of the State into wheat, cotton, and stock-raising districts is no matter of accident, nor is it a matter of choice on the part of those engaged in the various industries. While usually there is no room for doubt in the middle of each area as to the crop it is best adapted to, there is always a question along the boundaries. For instance, where does the successful production of cotton yield to that of wheat? Nature in her processes avoids sharp lines and hard-and-fast rules, but usually gives reliable averages. Even after a season of copious rainfall in a valley clothed with cactus and scrubby mesquite trees, the experienced ranchman knows better than to plow and plant with the idea that the following season will be similar; but from the character of the vegetation and of the animals present he may not only learn approximately the average amount of rainfall, but also the life zone in which he is located, with its average range of temperature and many of the crops best adapted to it. While much has been done and much more will be done to overcome arid conditions and to convert the now almost worthless desert soil into the most productive in the State, the normal conditions limiting life zones can not be materially overcome, nor can they be safely ignored. The attempt to raise cotton in Upper Sonoran zone results only in failure and loss, but enough of this zone lies within the State to produce, with the water available for irrigation, an abundance of the finest apples, as well as many other fruits and crops not adapted to lower zones.

The primary object of the present report is a careful definition of the ranges of native species of plants and animals and a correlation of these ranges into well-defined areas of distribution. In 'Life Zones and Crop Zones of the United States' Doctor Merriam has given, with as much detail as the data collected to 1898 would allow, the adaptation of various crops to the zones and their subdivisions, and has clearly set forth the practical application of the knowledge f faunal areas to agriculture. Under the heading 'Relations of the iological Survey to Practical Agriculture,' he says:[a]

> The Biological Survey aims to define and map the natural agricultural belts f the United States, to ascertain what products of the soil can and what can ot be grown successfully in each, to guide the farmer in the intelligent introuction of foreign crops, and to point out his friends and his enemies among e native birds and mammals, thereby helping him to utilize the beneficial nd ward off the harmful. * * * *
>
> The farmers of the United States spend vast sums of money each year in rying to find out whether a particular fruit, vegetable, or cereal will or will ot thrive in localities where it has not been tested. Most of these experiments sult in disappointment and pecuniary loss. It makes little difference whether e crop experimented with comes from the remotest parts of the earth or from neighboring State, the result is essentially the same, for the main cost is the bor of cultivation and the use of the land. If the crop happens to be one hat requires a period of years for the test, the loss from its failure is proporionately great.
>
> The cause of failure in the great majority of cases is climatic unfitness. he quantity, distribution, or interrelation of heat and moisture may be at ault. Thus, while the total quantity of heat may be adequate, the moisture ay be inadequate, or the moisture may be adequate and the heat inadequate, r the quantities of heat and moisture may be too great or too small with espect to one another or to the time of year, and so on. What the farmer ants to know is *how to tell in advance* whether the climatic conditions on his wn farm are fit or unfit for the particular crop he has in view, and what crops he can raise with reasonable certainty. It requires no argument to show that the answers to these questions would be worth in the aggregate hundreds of thousands of dollars yearly to the American farmer. The Biological Survey aims to furnish these answers.

Agricultural colleges, experiment stations and substations, horticulturists, and countless farmers are working out the details of these problems in different parts of the country and constantly pushing their experiments into new regions. As a crop becomes an established success in one locality, a study of the zone map will show over what adjoining country it can be profitably extended. For instance, Roswell, N. Mex., where apple raising has proved a great financial success, is situated at the junction of Upper and Lower Sonoran zones, or in a mixed belt of overlapping of the two, at the western edge of the Staked Plains. By tracing this lower border of Upper Sonoran zone around the southern arm and along the eastern edge of the Staked Plains, a belt approximately 1,000 miles long of the same zonal level and climatic conditions is found, lying within the State of Texas. This is largely undeveloped agricultural land, but a considerable part of it can be irrigated, and there is every reason to believe that it will be found perfectly adapted to the varieties of apples that thrive in the Pecos Valley at Roswell. The Staked

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[a] Life Zones and Crop Zones of the United States, by C. Hart Merriam. Bul. 10, U. S. Dept. Agr., Div. Biol. Survey, pp. 9, 12, 1898.

Plains, lying within this belt, are pure Upper Sonoran, the real home of most of the standard varieties of apples. Other northern crops, both cereals and fruits, have proved a success along this southern projection of Upper Sonoran zone, but have not been introduced as systematically as the advantages of its position seem to warrant. To quote again from Life Zones and Crop Zones, page 15, under the heading "Special value of narrow extensions of faunas," Doctor Merriam says:

> In looking at the map of the life zones it will be seen that nearly all of the belts and areas send out long arms, which penetrate far into the heart of adjoining areas. When such arms occupy suitable soils in thickly inhabited regions, so that their products may be conveniently marketed, they are of more than ordinary value, for the greater the distance from its area of principal production a crop can be made to succeed the higher price it will command. Hence, farms favorably situated in northern prolongations or islands of southern zones, or in southern prolongations or islands of northern zones, should be worth considerably more per acre than those situated within normal parts of the same zones. The obvious reason is that by growing particular crops at points remote from the usual sources of supply, and at the same time conveniently near a market, the cost of transportation is greatly reduced and the profit correspondingly increased.

Since the publication of Doctor Merriam's zone map, detailed work in Texas has enabled me to make minor corrections and to establish the zone boundaries with more precision than has been possible heretofore.

TROPICAL ELEMENT OF THE LOWER RIO GRANDE REGION.

Until recent years more thorough biological collecting had been done in the Lower Rio Grande region than in any other part of Texas, with the result of giving a somewhat exaggerated impression of the tropical element found there. Later and more systematic field work over the State, together with the extensive investigations of Nelson and Goldman in Mexico, have shown that the Texas mammals of tropical groups—as the armadillo, ocelot, jaguar, red and gray cats, and spiny pocket mouse—elsewhere range through Lower Sonoran zone, or at least its Tamaulipan subdivision, while a more critical study of these groups, based on the rapidly increasing amount of material, has resulted in every case in the specific or subspecific separation of the Texas forms. The single specimen of *Nasua*, apparently of a tropical species, from Brownsville may have been imported, and if this is so not a strictly tropical mammal reaches the border of Texas.

The close proximity to the Tropics is shown most pronouncedly by the birds of the Lower Rio Grande region. A considerable number of species, mainly tropical in distribution, reach southern Texas some breed regularly, while others are more or less regular [illegible]

[illegible] OF MAINLY TROPICAL RANGE WHICH EXTEND INTO SOUTHERN TEXAS

[illegible] brachypterus.	Polyborus cheriway.
[illegible] mexicanus.	Glaucidium phalaenoides.
[illegible]	Crotophaga sulcirostris
[illegible]	Ceryle torquata
[illegible]	Ceryle americana septentrionalis
[illegible]	Nyctidromus albicollis merrilli.
[illegible]	Amazilia tzacatl.
[illegible]	Amazilia cerviniventris chalconota.
[illegible]	Tyrannus melancholicus couchi
[illegible]	Pitangus derbianus.
[illegible] brachyptera	Myiarchus mexicanus.
[illegible]	Pyrocephalus rubineus mexicanus.
[illegible]	Ornithion imberbe.
[illegible]	[illegible]
[illegible]	Agelaius phoeniceus richmondi.
[illegible] harrisi.	Megaquiscalus major macrourus
[illegible]	Arremonops rufivirgatus
[illegible]	Sporophila morelleti
[illegible]	[illegible]
[illegible]	Geothlypis poliocephala

[illegible] species of reptiles supposed to be of tropical origin [illegible] Texas, but the task of verifying the records and determining [illegible] has not been undertaken in connection with the present work. In the case of plants, as of mammals, the tropical element of [illegible] Texas has been overestimated. A number of [illegible] that are mainly tropical extend into the Lower Rio Grande [illegible] but very few species of known tropical range [illegible] (Cook) is found [illegible] region, but apparently [illegible] of zonal significance. [illegible] the southern limits and zonal [illegible] determined, but evidently [illegible] important place in the flora of the Lower Rio Grande [illegible] absence or scarcity of tropical [illegible] Bray in the Botanical [illegible]

[illegible]

[illegible] Probably [illegible]

[illegible] in this region [illegible]

[illegible]

A striking example of the fatal effects of a 'norther' was witnessed over the coast region of Texas from Galveston to Port Lavaca in the spring of 1899, following the extremely cold wave of the preceding February, when the abundant huisache trees were killed to the ground. In the Brownsville region, however, as I found in the following spring, these trees had escaped, but all of the bananas had been killed. Under such climatic conditions tropical species could hardly be expected to persist, and it is not surprising that the preponderating species of plants and mammals are those characteristic of Lower Sonoran zone. Nor is it surprising that tropical species of birds, with their greater freedom of motion, should overlap the limits of their zone slightly beyond the more stationary groups.

Bananas offer a good illustration of the partial success of a tropical fruit in this region. During a period of warm years they thrive and even bear fruit, but only to be killed by the first hard freeze. Even at Brownsville they require artificial protection to insure their living through the winter. Oranges in like manner are a partial success, but an assured success only where artificial protection can be afforded during the winter.

LOWER AUSTRAL ZONE.

By far the greater part of Texas, including all but the Staked Plains with their northern and southern extensions and the mountain elevations in the western part of the State, lies within the Lower Austral, or cotton-producing zone, the subdivisions of which within the limits of the State equal, if they do not exceed, in practical importance the more restricted intrusions of other transcontinental zones. The most important of these subdivisions of Lower Austral are the narrow Gulf strip, with its semitropical climate, and the Austroriparian, or humid eastern, and Lower Sonoran, or arid western, areas, which divide the zone in Texas into approximately equal parts.

GULF STRIP OF TEXAS.

A compartively narrow strip of country bordering the Gulf coast of Texas is characterized by a limited number of species of unquestioned tropical affinities, ranging as extensions from Mexico or Florida part or all of the way along the Gulf coast, but not extending back over the rest of Lower Austral zone. While associated with a preponderance of characteristic Lower Austral species, they mark a border of modified climatic conditions too important to be ignored. This strip has been mapped as a semitropical or Gulf strip of the Lower Austral zone, of which it is merely a subdivision.

In mammals the best representatives of a mainly tropical group (subgenus *Baiomys*) are the little *Peromyscus taylori* and its subcies *subater*, which inhabit the coast prairies from Brownsville to lveston. Among birds the caracara, a bird of wide tropical range, ommon in the coast region of Texas as far east as Port Lavaca, ile the jackdaws—the great-tailed and boat-tailed grackles—of the us *Megaquiscalus*, extend in one form or the other from the tropics eastern Mexico along the Gulf coast to Florida, and breed abun- ıtly along the whole Texas coast region.

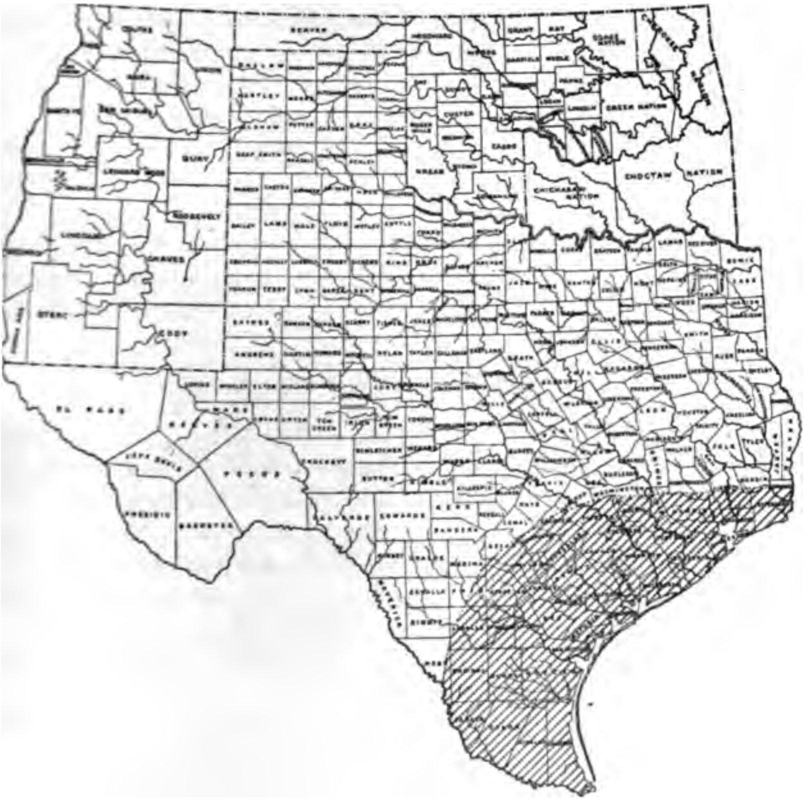

FIG. 1.—Distribution area of huisache (*Vachellia farnesiana*).

In plants some of the species marking the Gulf strip extend into e tropical regions of Mexico or Florida, while others are limited to ne part of this narrow strip. As stated by Professor Bray,[a] the itlines of the strip are approximately indicated in Texas by the ige of *Vachellia* (=*Acacia*) *farnesiana* and *Parkinsonia aculeata*, th species of partly tropical range, and to these I should add *aubentonia longifolia* (*Sesban cavanillesii*) and *Lantana camara* as ually important, while others of less extensive range in Texas are

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[a] Botanical Gazette, August, 1901, 103.

Castela nicholsonii, *Amyris parvifolia*, *Karwinskia humboldtiana*, *Ibervillea lindheimeri*, *Castalia elegans*, *Yucca treculeana*, *Manfreda maculosa*, *Tillandsia baileyi*, *Jatropha macrorhiza* and *multifida*, *Malpighia glabra*, and *Solanum triquetrum*. It is worthy of note that none of these plants enter the swamp and timber country to any extent.

AUSTRORIPARIAN OF EASTERN TEXAS.

The eastern part of Texas, west to approximately the ninety-eighth meridian, agrees very closely in climate, physiography, and the bulk of its species of plants and animals with the lower Mississippi Valley. Except for the strip of coast prairie, and farther north the areas known as the Black Prairie and Grand Prairie,[a] it is largely a forested region, comprising both deciduous and coniferous trees and inhabited by forest species of birds and mammals.

While a rich though only half-developed agricultural region devoted mainly to cotton, corn, fruits, and vegetables, it still comprises extensive areas of native forest and uninhabited cypress swamps. Most of the numerous streams have wide bottom lands subject to occasional floods, from which they derive a deep rich soil especially adapted to luxuriant forest growth. These rich bottoms are largely grown up to sweet gum, sour gum, various oaks, swamp hickory, sycamore, willow, holly, and magnolia, while along the streams and in swamps and shallow lagoons the cypress, tupelo gums, and palmettoes are often the characteristic growth. Where interlaced with vines these bottom-land forests are almost impenetrable thickets. The uplands and ridges are usually more openly forested with deciduous trees, such as oaks, hickories, dogwood, and sassafras, or often densely covered with one or more of the three species of pines which furnish most of the lumber of the State. Of these *Pinus taeda* and *echinata* are distributed over the State as far west as Houston, Hockley, Trinity, and Palestine in about equal abundance. The longleaf pine (*Pinus palustris*) occupies the southeastern part of the State, and where untouched by ax or fire forms miles of dense forest of the cleanest, most uniform, and symmetrical body of pine to be found on the continent, excelling the yellow pine forests of Arizona and California in the close array of graceful trunks.

In eastern Texas many species stop short of filling the whole humid area, and when their ranges are carefully mapped are found to be absent from, or in fewer cases to be restricted to, some of the following nonforested sections: The Grand and Black prairies of the Fort Worth and Dallas region; the coast prairie; coast marshes; islands and beaches.

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[a] Physical Geog. of the Texas Region. R. T. Hill, U. S. Geol. Survey, Topographic Atlas, p. 13, 1900.

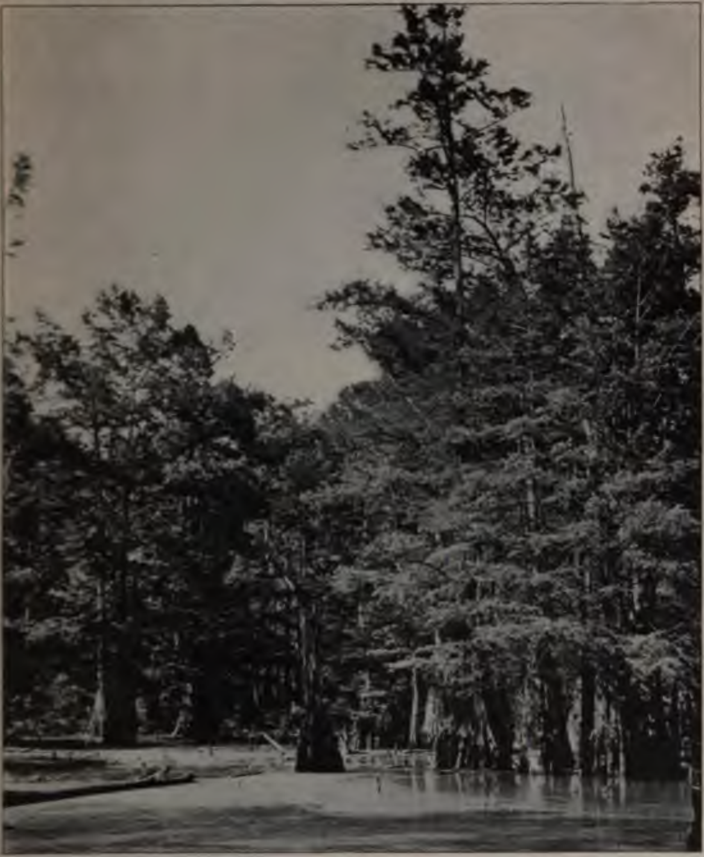


FIG. 1.—CYPRESS SWAMP, NEAR JEFFERSON.

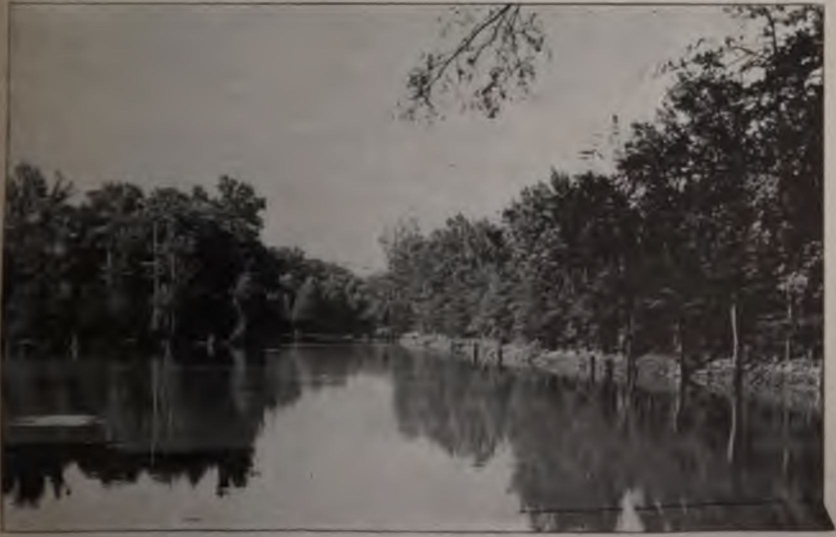


FIG. 2.—MIXED SWAMP TIMBER NEAR JEFFERSON, EASTERN TEXAS.

GRAND AND BLACK PRAIRIES.

The Grand and Black prairies, lying parallel, with only the narrow strip of Lower Cross Timbers between, extend from near Austin north in a broad strip to the Red River bottoms and east to Paris, forming an extensive area over which trees and forest species are mainly restricted to narrow stream bottoms. The rich black 'waxland' soil of these prairies is almost proof against burrowing rodents, which penetrate the region only along some sandy stream bottoms, while the open country tempts jack rabbits, coyotes, and other plains species eastward slightly beyond their usual bounds. Few, if any, species are restricted to these prairies, however, and the effect on distribution is mainly negative.

Here and there island strips of rich soiled grassy prairie occur in the timbered region farther east, becoming smaller and less frequent as they recede from the Black Prairie and Grand Prairie, and in some cases these islands are inhabited by a few plains species of birds, mammals, and reptiles nearly to the eastern edge of the State. Such an example is Nevils Prairie, near Antioch, where N. Hollister found scissor-tailed flycatchers, jack rabbits, and horned toads.

COAST PRAIRIE.

Over a wide strip of level coast prairie, extending along the Gulf from western Louisiana to San Antonio Bay and irregularly beyond, the timber is restricted to relatively narrow strips in the river bottoms, while the greater part of the surface is characterized by a rich growth of grass and many flowering plants. Spreading live oaks, loaded with Spanish moss, border the prairies or grow in scattered motts over them. In addition to the strictly shore species and those of the salt marshes which occasionally range over it or follow up the rivers to the limits of the open country, a few species of birds and mammals are characteristic of these coast prairies.

The most characteristic mammals are *Didelphis v. pigra*, *Peromyscus taylori* and *subater*, *Oryzomys palustris*, *Reithrodontomys aurantius*, *R. merriami*, *Sigmodon h. texianus*, *Microtus ludovicianus*, *Geomys sagittalis*, *Lepus merriami*, and *Spilogale indianola*, and of these *Peromyscus taylori* and *subater*, *Microtus ludovicianus*, and *Geomys sagittalis* are, so far as known, restricted to it.

The characteristic breeding birds of the coast prairies are *Tympanuchus attwateri*, *Otocoris a. giraudi*, *Megaquiscalus major* and *macrourus*, *Ammodramus m. sennetti*, *Coturniculus s. bimaculatus*, and *Geothlypis t. brachidactyla*.

Among its flowering plants *Baptisia*, *Oenothera*, *Meriolix*, *Hartmannia*, *Monarda*, *Coreopsis*, *Ratibida*, *Grindelia*, *Callirhoe*, *Eustoma*, and *Hymenocallis* are conspicuous genera, with numerous species, while such low shrubs as *Daubentonia longifolia*, *Vachellia farnesiana*, *Morella cerifera*, *Ascyrum*, and low willows are found here and there in favorable localities.

COAST MARSHES.

Extensive marshes border the Gulf shore irregularly as far west as Port Lavaca, and recur at intervals, mainly near the mouths of the streams, to the Rio Grande. These brackish, sedgy, tide-washed marshes are inhabited by rice rats, rails, water snakes, and great numbers of crustaceans. They are favorite resorts also for numerous migrating waders and water birds.

BEACHES AND ISLANDS.

The Gulf beaches and low islands offshore have a largely maritime fauna, the most striking feature of which is the abundance of shore birds, pelicans, cormorants, gulls, and terns. Not until the long reef-like bar of Padre Island is reached do we find any restricted forms of island mammals, and here only two—*Perodipus compactus* and *Geomys personatus*.

The following species and subspecies of mammals, breeding birds, reptiles, and plants occur more or less commonly in the Austroriparian or humid subdivision of Lower Austral zone in eastern Texas, but rarely, if at all, in the arid western subdivision of the zone. None of the lists are complete.

MAMMALS OF EASTERN TEXAS AUSTRORIPARIAN.

Didelphis virginiana.
Didelphis virginiana pigra.
Sciuropterus volans querceti.
Sciurus ludovicianus.
Sciurus carolinensis.
Citellus tridecemlineatus texensis.
Peromyscus gossypinus.
Peromyscus leucopus.
Peromyscus taylori subater.
Oryzomys palustris.
Reithrodontomys aurantius.
Reithrodontomys merriami.
Neotoma floridana rubida.
Sigmodon hispidus texensis.
Microtus pinetorum auricularis.
Microtus ludovicianus.
Castor canadensis texensis.
Geomys breviceps.
Geomys sagittalis.
Perognathus hispidus spilotus.
Lepus floridanus alacer.
Lepus aquaticus.
Lepus aquaticus attwateri.
Felis (sp.?) (panther).
Lynx rufus texensis.
Canis ater.
Vulpes fulvus.
Urocyon cinereoargenteus floridanus.
Ursus luteolus.
Procyon lotor.
Lutra (*canadensis?*).
Lutreola lutreocephala.
Spilogale indianola.
Mephitis mesomelas.
Conepatus mesoleucus telmalestes.
Scalopus aquaticus.
Blarina brevicauda carolinensis.
Blarina parva.
Nycticeius humeralis.
Lasiurus borealis.
Lasiurus borealis seminolus.
Pipistrellus subflavus..

BIRDS BREEDING IN EASTERN TEXAS AUSTRORIPARIAN.

[illegible] *ruficollis.*
[illegible] *caerulea.*
[illegible]
[illegible] *americanus.*
[illegible] *americanus* [illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible] *principalis.*
[illegible]
[illegible] *audubonii.*
[illegible]
[illegible]
[illegible] *erythrocephalus.*
[illegible]
[illegible] *auratus*
[illegible]
[illegible]
[illegible] *chapmani.*
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible] *floridanus*

Icterus galbula.
Quiscalus quiscula aeneus.
Megaquiscalus major.
Spizella socialis.
Spizella pusilla
Peucaea aestivalis bachmani.
Cardinalis cardinalis.
Guiraca caerulea.
Cyanospiza cyanea.
Piranga rubra
Vireo olivaceus.
Vireo noveboracensis
Vireo flavifrons
Mniotilta varia
Protonotaria citrea.
Dendroica dominica albilora.
Dendroica [illegible]
Geothlypis trichas brachidactyla.
Geothlypis formosa
Icteria virens
Wilsonia mitrata
Mimus polyglottos
Galeoscoptes carolinensis
Thryothorus ludovicianus
Sitta carolinensis
Sitta pusilla
Baeolophus bicolor
Parus [illegible]
Polioptila [illegible]
Hylocichla [illegible]
Sialia [illegible]

A FEW OF THE LIZARDS AN[illegible]

[illegible]

[illegible] *carolinensis*
[illegible] *ornatum* (local form)
[illegible] *ventralis*

[illegible]

[illegible]

[illegible]
[illegible]
[illegible]
[illegible]
[illegible] *transversa*
[illegible] *dekayi*
[illegible] *proxima*

PLANTS CHARACTERISTIC OF HUMID EASTERN IN DISTINCTION FROM ARID WESTERN TEXAS.

Pinus taeda.
Pinus palustris.
Pinus echinata.
Taxodium distichum.
Juniperus virginiana.
Liquidambar styraciflua.
Nyssa sylvatica.
Nyssa aquatica.
Platanus occidentalis.
Magnolia fœtida.
Magnolia virginiana.
Tilia leptophylla.
Acer drummondi.
Acer rubrum.
Hicoria ovata.
Hicoria alba.
Hicoria glabra.
Hicoria aquatica.
Juglans nigra.
Castanea pumila.
Carpinus caroliniana.
Ostrya virginiana.
Betula nigra.
Quercus phellos.
Quercus nigra.
Quercus marylandica.
Quercus digitata.
Quercus rubra.
Quercus virginiana.
Quercus acuminata.
Quercus macrocarpa.
Quercus lyrata.
Quercus minor.
Quercus alba.
Populus deltoides.
Salix (nigra?).
Ulmus americana.
Ulmus fulva.
Ulmus alata.
Toxylon pomiferum.
Celtis mississippiensis.
Asimina triloba.
Diospyros virginiana.
Sassafras sassafras.
Cynoxylon floridum.
Cratægus spathulata.
Cratægus texana.
Persea borbonia.
Leitneria floridana.
Ilex opaca.
Ilex decidua.
Ilex vomitoria.
Ilex lucida.
Morus rubra.
Gleditsia tricanthos.
Gleditsia aquatica.
Fagara clavaherculis.
Aralia spinosa.
Viburnum rufotomentosum.
Viburnum molle.
Viburnum (nudum?).
Callicarpa americana.
Cyrilla racemiflora.
Vaccinium sp. ——?
Morella crispa.
Azalea sp. ——?
Schmaltzia lanceolata.
Schmaltzia copallina.
Rhus radicans.
Cephalanthus occidentalis.
Rhamnus caroliniana.
Hamamelis virginiana.
Vitis sp. ——?
Smilax laurifolia.
Smilax (renifolia?).
Smilax pumila.
Gelsemium sempervirens.
Bignonia crucigera.
Campsis radicans.
Bradleia (wisteria).
Passiflora incarnata.
Rubus (trivialis?).
Rubus (procumbens?).
Yucca louisianensis.
Yucca arkansana.
Sabal adiantinum.
Arundinaria macrosperma.
Dendropogon usneoides.
Mitchella repens.
Sphagnum sp. ——?

For crops of the Austroriparian faunal area of the United States see Life Zones and Crop Zones, page 46, under the headings ‘Cereals,’ ‘Fruits,’ ‘Nuts,’ and ‘Miscellaneous.’ Only a part of the [illegible] are adapted to the east Texas region, however, while [illegible] have been introduced since the preparation of these [illegible]

LOWER SONORAN OF WESTERN TEXAS.

[illegible] annual rainfall decreases gradually from about 50 [illegible] eastern part of the State to about 10 inches in the [illegible] part. While the extremes are so great and there is [illegible] from eastern humid to western arid, there is still [illegible] division between the two regions, approximately [illegible] rainfall diminishes to below 30 inches, or near the [illegible]. By combining the limits of range of east [illegible] species of mammals, birds, reptiles, and plants an [illegible] of change can be traced across the State, beginning [illegible] the ninety-eighth meridian, just east of Henrietta, and [illegible] Lampasas, Austin, Cuero, and Port Lavaca. The [illegible] a general way to the eastern limit of the mesquite, [illegible] nearly than any other tree or shrub fills the whole of the [illegible] Sonoran zone. While scattering outlying mesquite trees [illegible] farther east, the line is intended to mark the eastern [illegible] abundance, or the transition from eastern prairie [illegible] country to the region dominated by the mesquite and [illegible]

[illegible] the region may be again subdivided [illegible] of mesquite and abundant grass stretching [illegible] and from the northern Panhandle [illegible] and extreme arid, or region of [illegible] generally between the [illegible]

[illegible]

[illegible] largely [illegible] the scattered [illegible] trees, in places [illegible] as along [illegible] of the Lower R[illegible] growth characte[illegible] narrow strip of [illegible] toward the coast [illegible] nearly [illegible] extension [illegible] West of Matagorda [illegible]

[illegible] Mesquite [illegible]

[illegible] of Conifer [illegible]

[illegible] 1896 [illegible]

[illegible] L. Bray [illegible]

back from the coast by dense thickets, consisting of mesq
huisache, and numerous thorny shrubs mixed with cactus, or of m
of live-oak brush, in places only knee high; again, in dense jun
10 or 20 feet high, in patches, strips, or isolated oak 'motts.'
Cameron County the oak motts occur as widely scattered island
the prairie, and are usually made up of a few gnarled old t
Along the stream bottoms and on the low coast flats the chapa
is especially dense and in places almost impenetrable from
abundance of cactus and thorny branches that interlace over
trails. The bulk of this chaparral is composed of common
Lower Sonoran shrubs, such as *Momesia pallida*, *Zizyphus obt*
folia, *Condalia obovata*, *Koeberlinia spinosa*, *Opuntia engelma*
O. lepticaulis, and other associated species, which in this semia
region of rich soil grow with unusual vigor. Many other wi
distributed species, such as *Parkinsonia aculeata*, *Vachellia fa*
siana, *Tillandsia recurvata*, and *Manfreda maculosa*, range thro
it, while a few others are peculiar to it or barely extend into it f
farther south.

As Padre Island lies within this semiarid division, and is s
ciently large and isolated to provide a habitat for a few specie
mammals, the following brief description by William Lloyd,
traveled its whole length in November, 1891, is of interest:

> Padre Island is about 90 miles long, and at the south end runs out to a p
> the last 10 miles of which is not over a mile wide, while for the last 5 mil
> is only 300 or 400 yards wide. Its central and greater breadth is nearly 4 m
> including about two-thirds of the distance a muddy flat so soft that one s
> in it over 3 inches. From here it tapers again to its north extremity, whic
> about 300 yards wide. It is divided from the mainland by the Laguna Ma
> which is only about a mile wide from Point Isabel and 2 miles wide opp
> Arroyo Coloral. Here, however, the water is 8 to 10 feet deep in the chan
> Farther north at the noted wagon crossing, about 15 miles south of Co
> Christi, near the north end of the island, the channel is 7 miles wide, with
> water 4½ to 5 feet deep at its ordinary elevation, although south winds r
> it very rapidly so as to be impassable. The main island is surrounded b
> network of smaller islands, with Mustang Island at the north end separ
> from it by a channel a mile wide. The drift or wrack and floating timbers
> the Gulf side are rapidly embedded in the restless sand and form a nucleus
> the sand dunes which stretch along the beach and form the backbone of
> island. Beyond them are smaller mounds with some little vegetation, and
> their feet lie sandy fields of grass, broken by numerous salt-water lakes wh
> the sea has washed in from time to time.
>
> The island has no arborescent growth worth noticing, with the exception
> shin-oak, which extends from the north end for about a mile and continues
> sandy hills on the lagoon side for 5 or 6 miles farther. This is usuall
> inches to 18 inches high, but there are trees, perhaps a different species, 6
> feet high. As this oak is always loaded with acorns, even now it is the favo
> wintering ground of birds such as wood ibis, whooping and sand-hill cra
> Wild celery abounds also in the lagoon and attracts great numbers of duck
> various species.

A few willows, presumably *Salix nigra*, grow at the settlement and at one oint north of it, and a few patches of buttonbush, *Cephalanthus occidentalis*, ere observed, also a few stunted 'huisache,' *Acacia farnesiana*, and crab grass, ckleburr, and wild grapes. These are all on the north and center of the island, uth of which grow salt grass and various waxy and creeping plants.

Strange to say, neither hackberry, mesquite, nor Mexican persimmon, though undant on the adjacent mainland, have succeeded in obtaining a footing any- here, and two straggling prickly pears (*Opuntia engelmanni*) were the sole presentatives of the cactus family. Although palmetto and banana stumps ash ashore in great numbers, none were seen growing.

Gales cover the Gulf side of the island with débris that must come from the istricts of Tampico or Vera Cruz. An iguana was taken a short time since on e island, and at least three species of snakes, including the rattlesnake, occur ere. Deer and coyotes have been seen by several parties swimming or wading cross to and from the island and mainland.

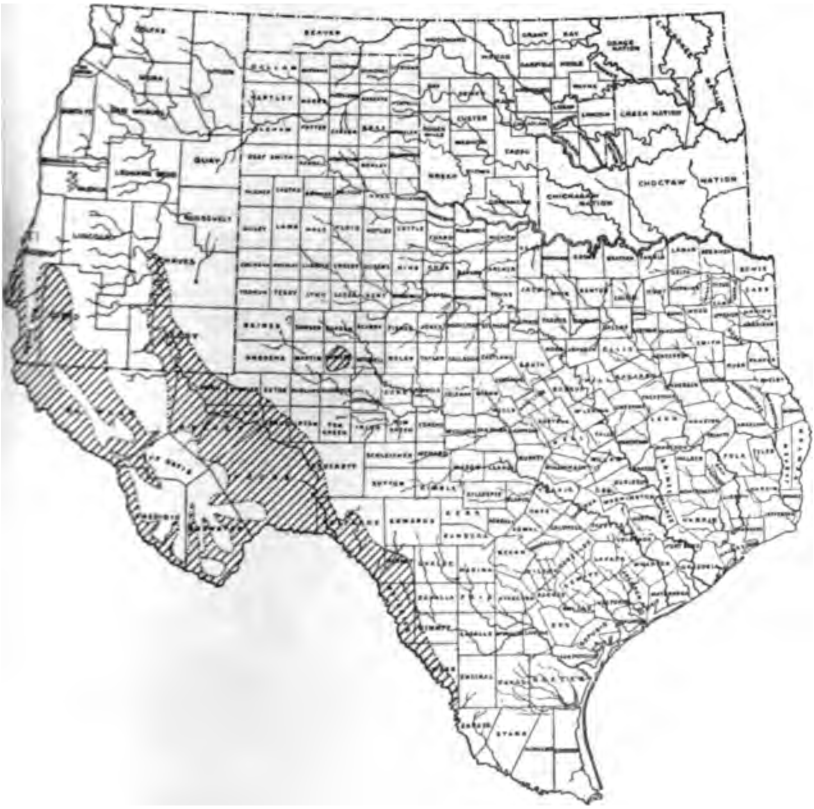


FIG. 2.—Distribution area of creosote bush (*Covillea tridentata*)

EXTREME ARID LOWER SONORAN.

The extreme arid section of the arid Lower Sonoran zone of Texas ludes the Pecos Valley and the Rio Grande Valley south to about gle Pass and all the country between the two valleys except the several mountain masses that rise as somewhat less arid Upper Sonoran and Transition zone islands. It has an irregular annual rainfall of 10 to 20 inches, and a half-barren soil, rich and mellow in the valleys, stony and baked on the mesas. It is subject to long, scorching drought, but after a single heavy rainfall bursts into verdure and bloom with a sudden brilliancy seen only in the desert. Its most characteristic shrub is the evergreen creosote bush, the range of which defines its extent better than any other plant, but its most conspicuous vegetation consists of yuccas, agaves, sotol, cactus, fouquiera, allthorn, and mesquite. Its mammals are mainly the species of the whole arid Lower Sonoran, but a few of these extend farther west without extending farther east than the Pecos Valley, among which are the following species:

Odocoileus hemionus canus.
Ammospermophilus interpres.
Citellus spilosoma arens.
Onychomys torridus.
Peromyscus leucopus texanus.
Peromyscus sonoriensis blandus.
Peromyscus eremicus.
Perognathus penicillatus eremicus.
Perognathus intermedius.
Perognathus nelsoni.
Perognathus nelsoni canescens.
Perognathus flavus.
Perognathus merriami gilvus.
Perodipus ordi.
Dipodomys merriami.
Dipodomys merriami ambiguus.
Geomys arenarius.
Thomomys aureus lachuguilla.
Canis mearnsi.
Vulpes macrotis neomexicanus.
Myotis californicus.
Myotis yumanensis.
Pipistrellus hesperus.
Corynorhinus macrotis pallescens.
Antrozous pallidus.
Promops californicus.

Including these somewhat mixed elements of semiarid, half open plains, strips of low prairie, dense cactus, thorny chaparral, and the more barren region of extreme aridity, under the heading of "Lower Sonoran Zone," we have in Texas an area which covers a little more than half of the State, and includes by far the largest number of species of mammals, birds, reptiles, and plants common to any subdivision in the State. It is characterized by the following species, some of which fill the subdivision and are restricted to it, while many more are restricted to definite areas within its limits, and still others range beyond through one or more of the other zones. Few of the species, however, extend through both arid and humid divisions of the zone without undergoing at least a subspecific change.

MAMMALS OF LOWER SONORAN OF WESTERN TEXAS.

Tatu novemcinctum texanum.
Didelphis marsupialis texensis.
Tayassu angulatum.
Odocoileus virginianus texanus.
Odocoileus hemionus canus.
Sciurus ludovicianus limitis.
Ammospermophilus interpres.
Citellus variegatus couchi.
Citellus buckleyi.
Citellus mexicanus parvidens.
Citellus spilosoma major.
Citellus s. arens.
Citellus s. annectens.
Onychomys torridus.

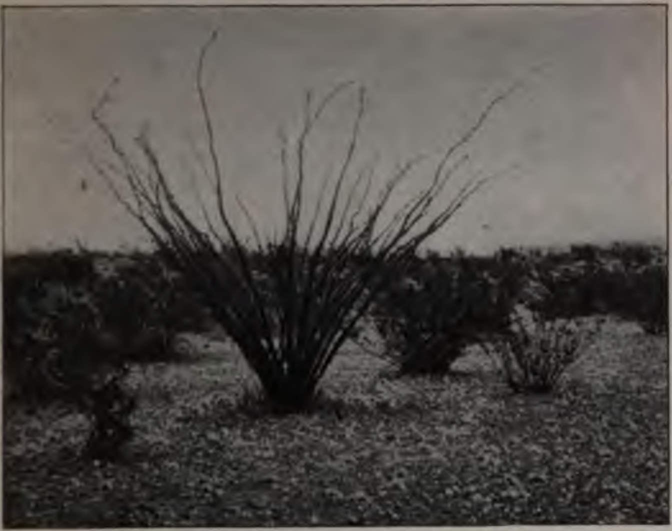


FIG. 1.—OCOTILLO (FOUQUIERA SPLENDENS) AND CREOSOTE BUSH (COVILLEA TRIDENTATA).

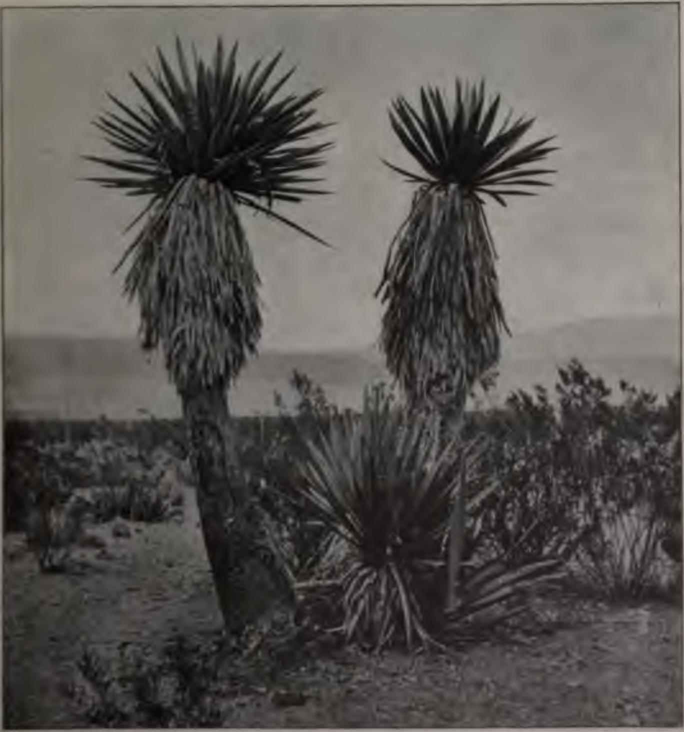


FIG. 2.—DESERT VEGETATION OF GREAT BEND REGION.

[illegible]
[illegible] texanus.
[illegible]
[illegible] pallescens.
[illegible] floridanus.
[illegible]

Thomomys perditus.
Lepus merriami.
Lepus texianus.
Lepus arizonæ minor.
Lepus floridanus chapmani.
Felis onca hernandezi.
Felis hippolestes aztecus
Felis pardalis limitis.
Felis cacomitli
Lynx texensis.
Canis latrans
Canis nebracensis texensis
Canis [illegible]
Canis [illegible]
Vulpes [illegible]
[illegible] *scottii.*
Bassariscus astutus flavus.
[illegible] *berlandieri*
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]

Micropallas whitneyi.
Crotophaga sulcirostris.
Geococcyx californianus.
Coccyzus americanus occidentalis.
Ceryle americana septentrionalis.
Dryobates scalaris bairdi.
Centurus aurifrons.
Phalænoptilus nuttalli.
Nyctidromus albicollis merrilli.
Chordeiles acutipennis texensis.
Amizilis cerviniventris chalconota.
Tyrannus vociferans.
Myiarchus cinerascens.
Sayornis saya.
Sayornis nigricans.
Pyrocephalus rubineus mexicanus.
Xanthoura luxuosa glaucescens.
Corvus corax sinuatus.
Corvus cryptoleucus.
Molothrus ater obscurus.
Tangavius æneus involucratus.
Sturnella magna hoopesi.
Icterus auduboni.
Icterus cucullatus sennetti.
Icterus parisorum.
Icterus bullocki.
Megaquiscalus major macrourus.
Carpodacus mexicanus frontalis.
Astragalinus psaltria.
Amphispiza bilineata.
Amphispiza b. deserticola.
Peucæa cassini.
Aimophila ruficeps eremœca.
Arremonops rufivirgata.
Cardinalis cardinalis canicaudus.
Pyrrhuloxia sinuata.
Pyrrhuloxia s. texana.
Guiraca cærulea lazula.
Cyanospiza versicolor.
Piranga rubra cooperi.
Phainopepla nitens.
Lanius ludovicianus excubitorides.
Vireo atricapillus.
Vireo belli medius.
Vireo b. arizonæ.
Vireo noveboracensis micrus.
Dendroica æstiva sonorana.
Dendroica chrysoparia.
Icteria virens longicauda.
Mimus polyglottos leucopterus.
Toxostoma longirostre sennetti.
Toxostoma curvirostre.
Heleodytes brunneicapillus couesi.
Salpinctes obsoletus.
Catherpes mexicanus albifrons.
Thryomanes bewicki cryptus.
Thryomanes b. leucogaster.
Bæolophus atricristatus.
Auriparus flaviceps.
Polioptila cærulea obscura.
Polioptila plumbea.

REPTILES OF LOWER SONORAN.

Lizards.

Crotaphytus reticulatus.
Crotaphytus wislizenii.
Holbrookia texana.
Holbrookia propinqua.
Holbrookia maculata.
Holbrookia m. lacerata.
Sceloporus clarkii.
Sceloporus spinosus floridanus.
Sceloporus consobrinus.
Sceloporus dispar.
Sceloporus merriami.
Phrynosoma cornutum.
Phrynosoma modestum.
Coleonyx brevis.
Ophisaurus ventralis.
Cnemidophorus tessellatus.
Cnemidophorus perplexus.
Cnemidophorus gularis.

Snakes.

Diadophis regalis.
Heterodon nasicus.
Bascanion flagellum.
Bascanion ornatum.
Drymobius margaritiferus.
Callopeltis obsoletus.
Drymarchon corais melanurus.
Rhinocheilus leconti.
Natrix fasciata transversa.
Eutainia elegans marciana.
Eutainia proxima.
Tantilla gracilis.
Elaps fulvius.
Agkistrodon piscivorus.
Crotalus atrox.

CONSPICUOUS PLANTS OF LOWER SONORAN.

[illegible] glandulosa.
[illegible] pubescens.
[illegible] constricta.
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible] texanum.
[illegible] amorphoides.
[illegible] undiflora
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible] folia
[illegible]
[illegible] phylla
[illegible]
[illegible]
[illegible] glauca
[illegible] texanum.
[illegible]
[illegible] folia.
[illegible]
[illegible]

Condalia spathulata.
Lycium berlandieri.
Lycium pallidum.
Leucophyllum texanum.
Leucophyllum minus.
Krameria canescens.
Fouquieria splendens.
Aloysia ligustrina.
Tecoma stans.
Ephedra antisyphilitica.
Ephedra trifurcata.
Croton torreyanus.
Bernardia myricaefolia.
Euphorbia antisyphilitica.
Mozinna spathulata.
Baccharis (salicina?).
Baccharis (glutinosa?).
Flourensia cernua.
Agave lechuguilla.
Hechtia texensis.
Tillandsia recurvata.
Tillandsia baileyi.
Yucca macrocarpa.
Yucca [illegible]
Yucca [illegible]
Yucca rostrata.
Yucca [illegible]
Samuela [illegible]
Samuela [illegible]
Hesperaloe [illegible]
Opuntia [illegible]
Opuntia [illegible]
Opuntia [illegible]
Cereus [illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]

crops adapted to Lower Sonoran [illegible] Life Zones [illegible] pages 12-15, under heading [illegible] Lower Sonoran Area," where under [illegible] are listed the varieties [illegible] of the area. Although [illegible] of the [illegible] region, and while [illegible] successful, the list will be found helpful [illegible] experiments.

Some practical suggestions may be derived also from the native species of plants, as in the case of *Schmaltzia mexicana*, variously known as *Rhus mexicana* and *Pistacia mexicana*, and related to the *Pistacia vera* of the Mediterranean region, from which the pistachio of commerce is obtained. In places in the canyons of the Rio Grand this large shrub grows in profusion, suggesting that the real *pistachio* also might succeed here.

One of the conspicuous plants often dominant over much of the

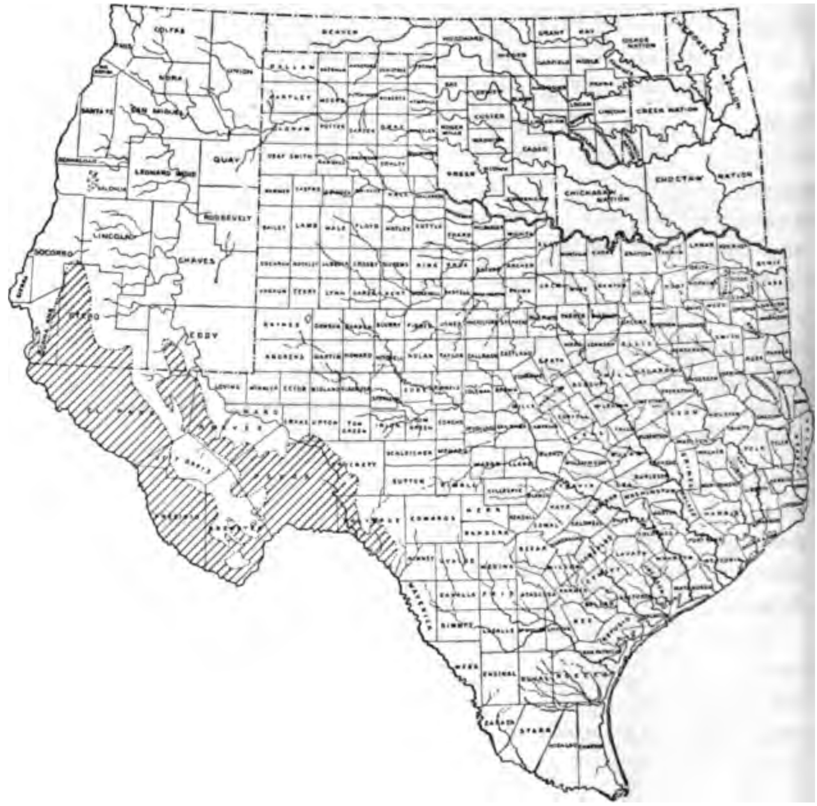


FIG. 3.—Distribution area of lecheguilla (*Agave lecheguilla*).

extreme arid Lower Sonoran zone of western Texas is a little century plant (*Agave lecheguilla*), best known by its Mexican name o 'lecheguilla.' Its rigid leaves are about a foot long, well armed witl marginal hooks and stout terminal spines, which effectually protec them from the attacks of grazing animals. Even the hardy burro and hungry goats refrain from eating them, and pick their way cautiously among their dagger points. But within each leaf is a bundle of smooth, strong fibers suitable for the manufacture of brushes, *matting*, coarse twine, and rope. These plants grow in greatest abundance over limestone and lava mesas and steep rocky slopes that can never be irrigated and are often too steep and rough for grazing, even if the scanty grass were not crowded out by the cactus and agaves. Here, over thousands of square miles of the most worthless part of the desert, is a crop, not only offering in its leaf fibers a profitable industry awaiting development, but also suggesting that other species of agaves, yielding fiber of still more valuable quality, can be successfully introduced into this region—a region that now lies unimproved and almost uninhabited while hundreds of thousands of dollars worth of agave fibers are annually imported from Mexico.

In the Davis and Chisos and Guadalupe mountains the large *Agave wislizeni* and *applanata*, the mescal plants of the Mescalero Apaches, offer a nutritious food that might well find place on our tables as a delicacy. They grow over the barest and roughest slopes, not only yielding in the starchy caudex a rich store of food, but in the beautiful flowers a quantity of delicious honey equaled by few other plants. A single plant during its flowering period of about a month bears from one to two thousand flowers, each yielding nearly half a teaspoonful of honey. That the country is well adapted to bees is evidenced by numerous and extensive bee caves in the rocks, by bee trees, and by the success of domestic swarms. The numerous leguminous shrubs—acacias, mimosas, and mesquites, several species of the 'bee bush' (*Lippia* and *Goniostachyum*), and the abundant flowers of numerous species of Compositæ—all yield rich stores of honey. In semiarid gulches where the native black-fruited Texan persimmon (*Brayodendron texanum*) bears an abundance of its almost worthless fruit it is probable that varieties of the delicious Japanese persimmon would thrive.

Other plants besides grass and cactus are important as food for stock or are of service to man. The sotol (*Dasylirion texanum*), with its double-edged saw-bladed leaves and stout caudex, when split open so that the inner starchy heart can be reached, yields a large amount of hearty food for stock. The plant is widely distributed over most of the region west of the Pecos and Devil rivers, and is most abundant over the barest and stoniest slopes. Like most desert plants, it is of slow growth, and its greatest value has been in tiding stock over periods of scarcity. Sotol cutting becomes an important business with sheep and cattle men when a dry summer is followed by a winter of bare pastures.

The value of the mesquite and screw bean (*Prosopis glandulosa* and *pubescens*) to stockmen and ranchers of western Texas can hardly be overestimated. Over much of the arid and semiarid region of the State they yield fuel, fence posts, and building material for the ranch, and also shade, shelter, and food for stock. The common mesquite, though rarely reaching the dignity of a tree and often dwarfed to a mere shrub, is the only available timber over thousands of square miles. The wood is heavy, strong, and durable. The feathery foliage, while so thin that grass grows under the trees, affords a welcome shade to man and beast. The fragrant, honey-laden, catkin-like flowers blossom quickly, and in warm weather after a good rain a crop of long bean pods will mature and ripen with

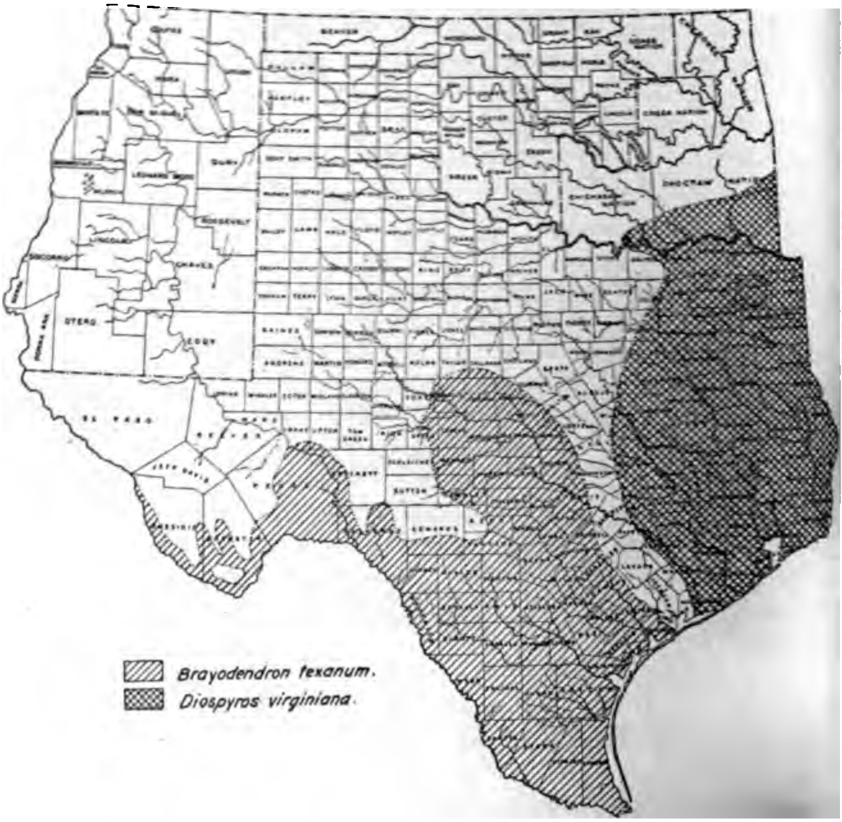


FIG. 4. Distribution area of the black and the yellow persimmons (*Brayodendron texanum* and *Diospyros virginiana*).

little regard to season. Often two crops a year mature if rains come at proper intervals. The sugary pods serve to fatten cattle, horses, mules, burros, sheep, and goats. The small, hard beans pass through animals and seed new ground, so that the spread and increase of the mesquite has been a notable result of stock raising. The use of the sweet, nutritious pods as food by both Indians and early settlers seems to have been mainly given up, but the actual food value of the pods needs no better demonstration than is afforded by the condition of animals feeding on them.

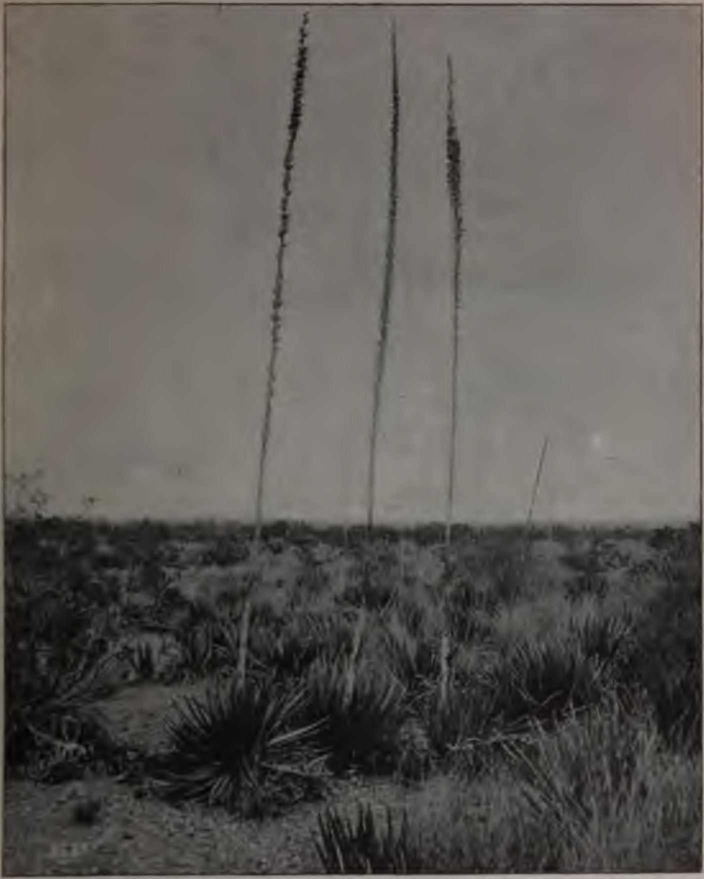


FIG. 1.—LECHEGUILLA WITH FLOWERS AND FRUIT.

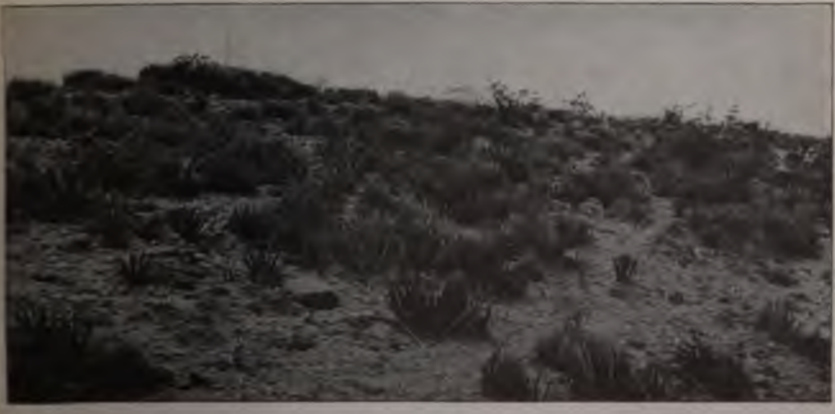


FIG. 2.—LECHEGUILLA (AGAVE LECHEGUILLA) NEAR BOQUILLAS, GREAT BEND OF RIO GRANDE.

AGAVE WISLIZENI IN FLOWER, DAVIS MOUNTAINS. HUMMINGBIRD AT FLOWER CLUSTER ON LEFT.

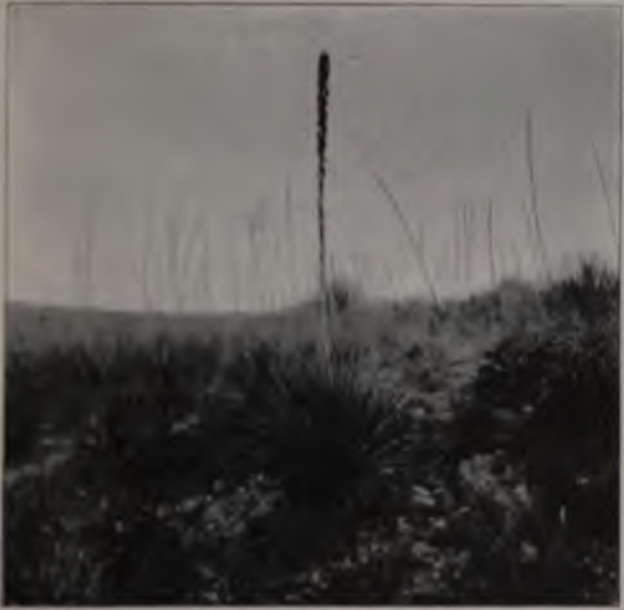


FIG. 1.—SOTOL ON MESA NEAR COMSTOCK.

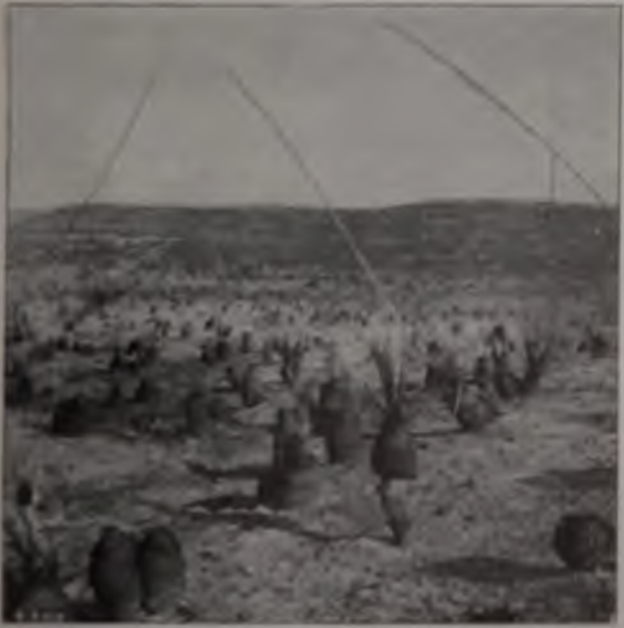


FIG. 2.—SOTOL AFTER THE LEAVES ARE BURNED OFF.

A much neglected product of the mesquite is the gum which exudes from the branches and can be gathered in large quantities. Apparently, it has all the qualities of gum arabic, the gum of closely related Old World acacias, and needs only introduction to a market to become of commercial value.

The seeds and pods of other leguminous shrubs, the acorns of several species of oaks, and the sugary berries of the alligator-barked juniper also are of considerable value in special areas as feed for stock or poultry.

UPPER AUSTRAL ZONE, UPPER SONORAN DIVISION.

East of the Pecos Valley, Upper Sonoran zone covers most of the Panhandle, the Staked Plains and the narrower secondary plain, or Edwards Plateau, running south as far as Rock Springs, as well as the tops and cold slopes of the ridges and bottoms of shaded gulches breaking down from the edge of these plains. West of the Pecos Valley it covers the foothills and lower slopes of the mountains, extending on southwest slopes nearly or quite to the tops of most of the peaks, but on the northeast slopes of the Guadalupe, Davis, and Chisos mountains giving place to Transition zone at about 6,000 feet. On such steep, arid slopes as these mountains present to the sun's rays the difference of zone level on opposite sides is often 2,000 or 3,000 feet, increasing with the steepness and barrenness of the slope. Over the mountains and rough country the zone is marked by a scattered growth of nut pines, junipers, and oaks, but over the plains, where short grass is the principal vegetation, its limits are often best determined by the absence of mesquite and other shrubs of the surrounding Lower Sonoran zone. Some of its most characteristic plants in the mountain region are *Pinus edulis* and *cembroides*, *Juniperus pachyphlœa*, *monosperma*, and *flaccida*, *Quercus grisea* and *emoryi*, *Adolphia infesta*, *Nolina texana*, *Mimosa biuncifera*, *Cercocarpus parvifolius*, *Garrya lindheimeri*, *Fallugia paradoxa*, *Yucca baccata*, *Agave wislizeni* and *applanata*, while those on the plains, aside from grasses, are *Asclepias latifolia* and *speciosa*, *Laciniaria punctata*, several species of *Psoralea* and *Astragalus*, *Polygala alba*, *Yucca glauca*, and *Opuntia cymochila*.

In the mountains and rough country Upper Sonoran zone is specially characterized by the occurrence in the breeding season of birds such as *Cyrtonyx mearnsi*, *Cæligena clemenciæ*, *Calothorax lucifer*, *Aphelocoma couchi*, *cyanotis*, and *texana*, *Pipilo mesoleucus*, *Vireo plumbeus* and *stephensi*, *and Psaltriparus plumbeus* and *lloydi*; and on the plains by such breeding species as *Podasocys montanus*, *Numenius longirostris*, *Chordeiles henryi*, *Poocætes confinis*, and *Otocoris leucolæma*.

In the mountains and rough country some of the most characteristic mammals of Upper Sonoran zone are *Ovis mexicana*, *Odocoileus couesi* and *canus*, *Citellus grammurus* and *couchi*, *Peromyscus rowleyi*, *attwateri*, and *laceyi*, *Neotoma attwateri* and *albigula*, and on the plains *Antilocapra americana*, *Odocoileus macrourus*, *Cynomys ludovicianus*, *Citellus pallidus*, *Onychomys pallescens*, *Perognathus paradoxus* and *copei*, *Perodipus richardsoni*, *Lepus melanotis*, *Vulpes velox*, *Putorius nigripes*.

Including both plains and mountain slopes, the Upper Sonoran zone in Texas is characterized by the following species:

MAMMALS OF UPPER SONORAN.

Ovis mexicanus.
Antilocapra americana.
Odocoileus couesi.
Odocoileus virginianus macrourus.
Citellus variegatus grammurus.
Citellus v. couchi.
Citellus tridecemlineatus pallidus.
Citellus spilosoma marginatus.
Cynomys ludovicianus.
Onychomys leucogaster pallescens.
Peromyscus sonoriensis.
Peromyscus rowleyi.
Peromyscus attwateri.
Peromyscus boylei laceyi.
Neotoma attwateri.
Neotoma albigula.
Thomomys baileyi.
Perognathus flavescens copei.
Perognathus hispidus paradoxus.
Perodipus richardsoni.
Lepus texianus melanotis.
Lepus arizonæ minor (mainly Lower Sonoran).
Lepus pinetis robustus (mainly Transition).
Felis hippolestes aztecus.
Lynx baileyi.
Canis griseus.
Canis nebracensis.
Vulpes velox.
Urocyon cinereoargenteus scotti (also Lower Sonoran).
Putorius nigripes.
Spilogale interrupta.
Mephitis mesomelas varians.
Taxidea taxus berlandieri.

BIRDS OF UPPER SONORAN.

Numenius longirostris.
Podasocys montanus.
Cyrtonyx montezumæ mearnsi.
Accipiter cooperi.
Chordeiles virginianus henryi.
Calothorax lucifer.
Cœligena clemenciæ.
Trochilus alexandri.
Phalænoptilus nuttalli.
Aeronautes melanoleucus.
Tyrannus verticalis.
Otocoris alpestris leucolæma.
Aphelocoma woodhousei.
Aphelocoma cyanotis.
Aphelocoma texana.
Aphelocoma sieberi couchi.
Cyanocephalus cyanocephalus.
Icterus bullocki.
Sturnella magna neglecta.
Carpodacus mexicanus frontalis.
Spizella socialis arizonæ.
Aimophila ruficeps scotti.
Pipilo fuscus mesoleucus.
Cyanospiza amœna.
Zamelodia melanocephala.
Ampelis cedrorum.
Vireo solitarius plumbeus.
Vireo gilvus swainsoni.
Troglodytes aëdon aztecus.
Bæolophus inornatus griseus.
Psaltriparus plumbeus.
Psaltriparus melanotis lloydi.

LIZARDS AND SNAKES OF UPPER SONORAN.

Lizards.

ytus collaris	*Phrynosoma hernandesi*
ytus [illegible]	*Gerrhonotus liocephalus infernalis.*
[illegible]	*Eumeces guttulatus.*
us torquatus poinsettii.	*Eumeces obsoletus.*
us consobrinus	*Eumeces brevilineatus*

Snakes.

[illegible]	*Chionactis episcopus isozonus.*
[illegible]	*Eutaenia cyrtopsis.*
[illegible]	*Crotalus molossus.*
[illegible]	*Crotalus lepidus.*
[illegible]	*Crotalus confluentus.*

PLANTS OF UPPER SONORAN PLAINS.

[illegible]	*Mentzelia nuda*
[illegible] tuberosa	*Astragalus mollissimus.*
[illegible]	*Astragalus caryocarpus*
[illegible] punctata	*Psoralea linearifolia.*
[illegible]	*Psoralea [illegible]*
[illegible]	*Parosela [illegible]*
[illegible]	*Acuan [illegible]*
[illegible]	[illegible]
[illegible]	*Hoffmanseggia [illegible]*
[illegible]	*Petalostemon [illegible]*
[illegible]	[illegible]
[illegible]	[illegible]
[illegible] petiolaris.	[illegible]
[illegible] erythra	[illegible]

PLANTS OF UPPER SONORAN [illegible]

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
undulata	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	
[illegible]	

two long strips of U[illegible] Valley at the [illegible] h they are peculiar[illegible] ll be in part [illegible] vantage of their [illegible] rounding Lower Sonoran Zone will be recognized. W[illegible] grazing will long continue to be the chief industry, the introduction of successful crops will be of the greatest advantage to the stockmen. Most of the region is semiarid, with only sufficient rainfall for a good stand of native grasses, but by intelligent methods of handling the soil, deep plowing, dust mulch, and a system of cross-furrowing to utilize all the water that falls on sloping areas many kinds of fruits and other crops will thrive without irrigation. Where irrigation is possible, however, as it is in many places along streams or by means of water storage, artesian wells, or pumping, the returns will, of course, be far more certain and abundant.

For lists of cereals, fruits, nuts, and miscellaneous crops adapted to Upper Sonoran zone see Life Zones and Crop Zones, pages 37–40. This is preeminently the zone of standard varieties of apples and of many other fruits and grains. It is the only zone of any extent in Texas adapted to the sugar beet for the manufacture of sugar.

TRANSITION ZONE.

The Transition is the most restricted and broken of any zone in the State, being confined to the Chisos, Davis, and Guadalupe mountains from about 6,000 feet on northeast slopes to the tops of the ranges, while between these mountains it is divided by wide strips of Upper Sonoran zone. It is well marked in each of these ranges by its most characteristic tree—the yellow pine (*Pinus ponderosa*)—but in each is characterized by a different combination of plants and animals. Although the home of the wild potato (*Solanum t. boreale*), it is too rough for extensive agriculture and is important mainly for its timber and for the hidden sources of streams that break out at lower levels.

In the Guadalupe Mountains the Transition zone mammals are:

Odocoileus (hemionus?).
Eutamias cinereicollis canipes.
Neotoma mexicana.
Microtus mexicanus guadalupensis.
Thomomys fulvus.
Lepus pinetis robustus.
Ursus (americanus?).

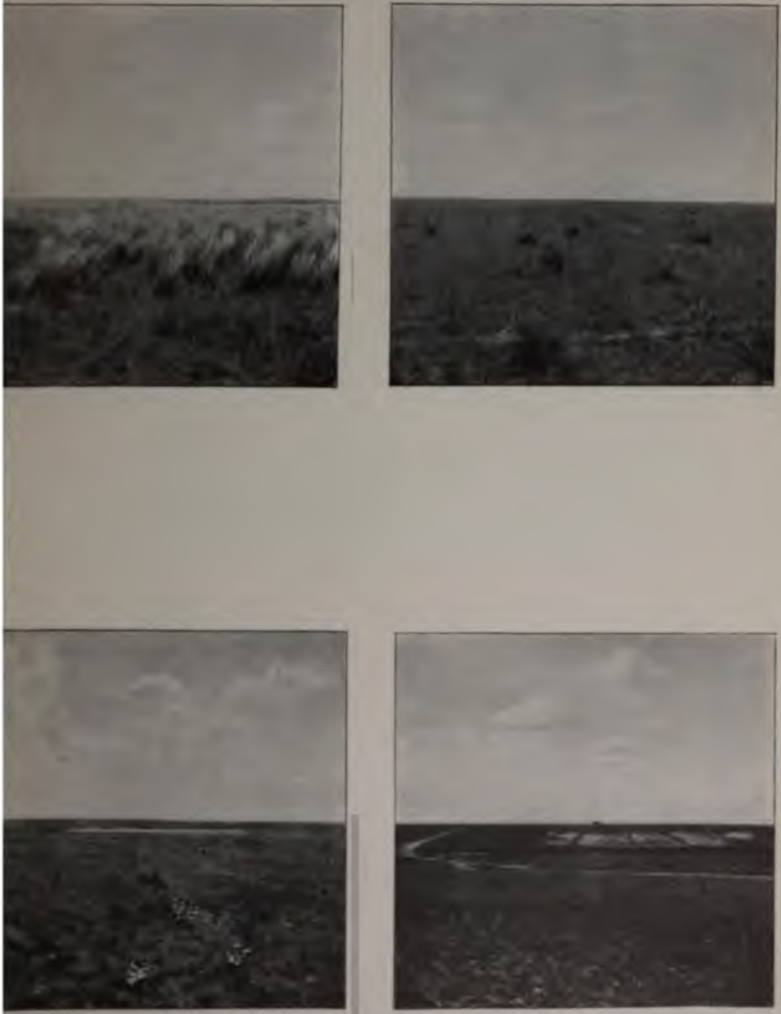
In the Davis Mountains:

Odocoileus sp. — — ?
Neotoma mexicana.
Thomomys fulvus texensis.
Erethizon sp. —— —?
Lepus pinetis robustus.
Ursus americanus ambliceps.
Ursus horribilis horriæus.
Vespertilio fuscus.

In the Chisos Mountains:

Odocoileus couesi.
Neotoma (mexicana?).
Sigmodon ochrognathus.
Lepus pinetis robustus.
Ursus a. ambliceps.
Vespertilio fuscus.

The lists of breeding birds of the Transition zone show little variation in the Guadalupe, Davis, and Chisos mountains, and more



VIEWS ON STAKED PLAINS NEAR HEREFORD AND DIMMITT.

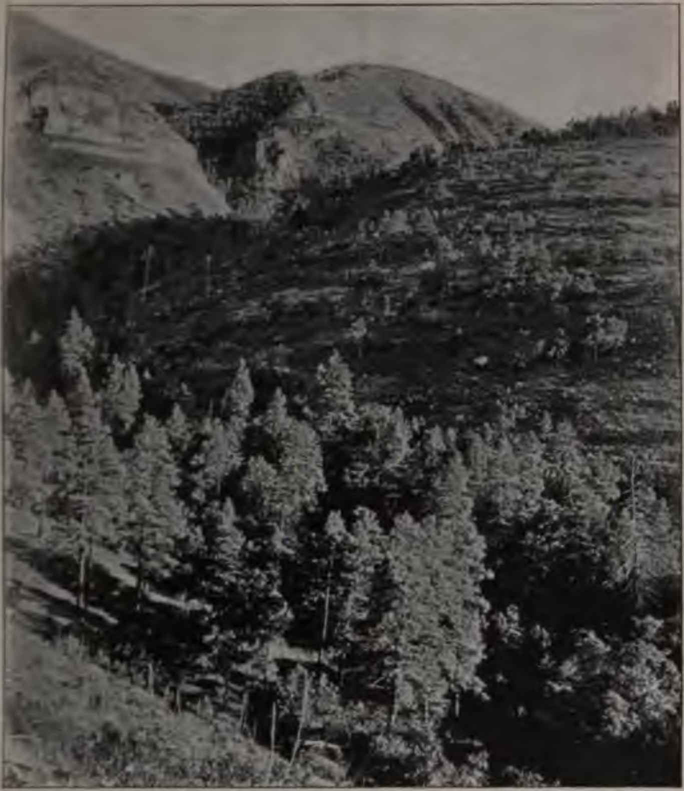


FIG. 1.—TRANSITION ZONE TIMBER OF GUADALUPE MOUNTAINS.

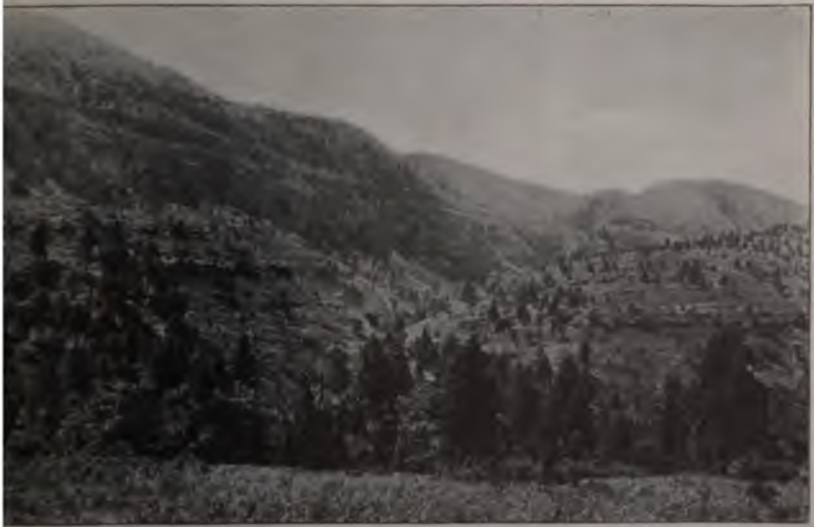


FIG. 2.—*HEAD OF DOG CANYON*, GUADALUPE MOUNTAINS.

Transition Zone Timber in Chisos Mountains. Altitude approximately 6,500 Feet.

Collecting high up in these ranges would doubtless show greater similarity of species.

The following species are common to all three ranges:

[illegible]	*Pipilo maculatus megalonyx.*
	Vireo solitarius plumbeus.
[illegible]	*Piranga hepatica*
	Sitta carolinensis nelsoni

The following species occur and probably breed in the Guadalupe [illegible]:

[illegible]	*Helminthophila celata orestera*
	Dendroica auduboni
	Dendroica graciae
[illegible]	*Sitta pygmaea*
	Hylocichla guttata auduboni
[illegible]	*Merula migratoria propinqua*

The following occur in both the Guadalupe and Davis Mountains [illegible]:

[illegible]	[illegible]
[illegible]	[illegible]

The following species occur in both the Guadalupe and Chisos [illegible] were not observed in the Davis Mountains:

[illegible]	[illegible]
	[illegible]

The following were found in the Chisos Mountains [illegible]:

[illegible]	[illegible]
[illegible]	[illegible]

[illegible] Mountains [illegible] a single [illegible] Rocky Mountains [illegible] according [illegible] Mountains [illegible] that [illegible] Transition zone plants of [illegible] M[illegible]

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible] undulata	[illegible]

Of the Davis Mountains:

Pinus ponderosa.
Pinus flexilis.
Acer grandidentatum.
Quercus leucophylla.
Quercus novomexicana.
Quercus grisea (dwarf form).
Quercus emoryi (dwarf form).
Prunus serotina acutifolia.
Rhamnus purshiana.
Symphoricarpos (*longiflorus?*).
Solanum tuberosum boreale.

Of the Chisos Mountains:

Pinus ponderosa.
Pseudotsuga mucronata.
Cupressus arizonica.
Acer grandidentatum.
Quercus grisea.
Quercus emoryi.
Quercus texana.
Prunus s. acutifolia.
Rhamnus purshiana.
Symphoricarpos (*longiflorus?*).

The Transition area is so restricted in Texas as to be of comparatively little agricultural importance, especially as it lies within the arid section of the zone. Its greatest value, aside from its native timber, will be found in its adaptation to the culture of northern fruits, varieties of apples, pears, cherries, plums, grapes, and berries that will never prove successful elsewhere in the State.

For list of fruits that have been grown successfully in arid Transition zone in western Montana, eastern Washington and Oregon, and in parts of Idaho and Utah, see Life Zones and Crop Zones, pages 25–27.

CANADIAN ZONE.

In the Davis Mountains a thicket of *Populus tremuloides* along the northeast base of a high cliff near Livermore Peak indicates a mere trace of Canadian zone, while a single specimen of the hoary bat, shot as it came down one of the gulches near the northeast base of Livermore Peak, July 10, strongly suggests that this Canadian zone species was on its breeding ground. *Nuttallornis borealis* and *Loxia curvirostra stricklandi* seen in the Chisos Mountains in June were probably breeding there, while *Nuttallornis borealis* and immature *Junco dorsalis*, observed in the Guadalupe Mountains in August, may or may not have been migrants.

REPORT ON THE BIOLOGICAL SURVEY COLLECTION OF LIZARDS AND SNAKES FROM TEXAS.

The Biological Survey collection of reptiles in the United States National Museum contains 353 specimens from Texas, including 102 specimens and 31 species of snakes from 81 localities, 252 specimens and 32 species of lizards from 167 localities. No attempt has been made to identify or include the turtles and batrachians. The material has been gathered by the field assistants of the Survey as opportunity offered in connection with other work, but none of the collectors has made a specialty of reptiles. Until a systematic field study of these groups is taken up, we can not expect to know much of the distribution and habits of the species; but so much that is vague, erroneous, and misleading has been published, especially in regard to the Texas region, that it seems doubly important to put on record all definite localities from which specimens have been positively identified. Every specimen in the present collection is fully labeled with exact locality, including altitude in the case of most specimens from the mountains, date, name of collector, and in many cases notes on habitat. Only a knowledge of the country is requisite to enable each specimen to be referred to its proper zone. Of some species there are specimens from enough localities to determine with considerable accuracy their range and zonal position in the State, but of many others the few records will be useful mainly in future works of broader scope.

But few of the collectors' field notes on reptiles, when unaccompanied by specimens, have been made use of owing to the danger of confusing closely related species, and when such notes are used they are carefully distinguished. In a few cases the records of specimens in the United States National Museum collection from localities of peculiar importance are given separately. References to published records usually are avoided.

To Dr. Leonhard Stejneger I am greatly indebted for identification of the specimens. With the aid of his assistant, Mr. Richard G. Paine, I was able to simplify his task in many cases by making preliminary determinations.[a]

Anolis carolinensis Cuvier. Carolina Chameleon.

This little chameleon-like lizard is represented in the collection by specimens from Waskom, Joaquin, Sour Lake, and Columbia, and I have seen it in abundance at Jefferson and Timpson, but never in the western half of Texa

Crotaphytus collaris (Say). Ring-necked Lizard.

Specimens of this beautiful lizard from Wichita Falls, Henrietta, Miami, Gail, Castle Mountains, Fort Lancaster, Fredericksburg, and Rock Springs, Tex., and from Roswell and Santa Rosa, N. Mex., carry the range of the species over the middle plains region of Texas, the region lying between the Pecos River and the eastern timbered country. The above localities lie near the junction of Upper and Lower Sonoran zones, but this lizard inhabits at least a part of both zones. Fourteen out of the 15 specimens referred to *collaris* have the single row of interorbital plates. One specimen from Miami has two full rows of interorbitals, but with the large supraoculars and blunt nose of *collaris*.

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[a] Additional specimens identified by Mr. Paine and myself during Doctor Stejneger's absence are as follows: From Sour Lake, *Crotalus horridus*, *Callopeltis obsoletus*, *Agkistrodon contortrix*, *Storeria dekayi*, *Sceloporus consobrinus*, *Anolis carolinensis*; from Hempstead, *Tropidoclonium lineatum*; from Seguin, *Eutainia elegans marciana* and *Sceloporus spinosus floridanus*; from Washburn, *Heterodon nasicus* and *Liopeltis vernalis*, and from Cleveland, *Elaps fulvius*.

Crotaphytus collaris baileyi Stejneger.

Nine specimens of *Crotaphytus* from eight localities are referred by Doctor Stejneger to *baileyi*. They are from Comstock, Alpine, Paisano, Chisos Mountains (west base), Davis Mountains (east base), Toyah, 70 miles north of Toyah, Tex., and one from the east base of Guadalupe Mountains, west of Carlsbad, N. Mex. These localities are near the junction of Upper and Lower Sonoran zones. Five of the nine specimens from Comstock, Paisano, and Chisos Mountains and two from the Davis Mountains are typical *baileyi*, with two full rows of interocular plates, small supraoculars, and relatively narrow muzzle. The specimen from Alpine has the interoculars joined in a single row, but otherwise possesses the characters of *baileyi*. The specimen from the Guadalupe Mountains and the two from Toyah and 70 miles north of Toyah have the interoculars joined in a single row and other characters intermediate between *baileyi* and *collaris*. Considering the close relationship and evident intergradation of the two forms, it seems best to follow Witmer Stone in placing *baileyi* as a subspecies of *collaris*.[a]

Crotaphytus reticulatus Baird.

Lloyd collected a specimen of this rare and apparently very locally distributed lizard at Rio Grande City, Tex., May 28, 1891.

Crotaphytus wislizenii Baird & Girard. Leopard Lizard.

A fine, large individual of this big, spotted lizard was shot near Boquillas, in the Great Bend of the Rio Grande, by McClure Surber, and Cary and Hollister each collected a specimen near Toyahvale, in the Pecos Valley. The species is not common and occurs only in the low, hot valleys of extreme arid Lower Sonoran zone.

Holbrookia texana Troschel.

This most brilliantly colored of the Texas lizards is represented by 11 specimens from the following nine localities: Fort Stockton, Adams, Toyahvale, Pecos River (5 miles west of Sheffield), Davis Mountains (east base), Boquillas, McKinney Spring (60 miles south of Marathon), Comstock, and Benbrook. It is a common and conspicuous species over all the hot, bare Lower Sonoran desert of western Texas and as far up the Pecos Valley as Santa Rosa, N. Mex.

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[a] Proc. Acad. Nat. Sci. Phila., 1903, 30.

This species is so similar in both general appearance and habits to *Callisaurus draconoides*, the 'gridiron-tailed lizard' of the Death Valley country, that I never noticed the difference between them until Doctor Merriam pointed it out in a beautiful colored study of *Holbrookia texana* made by Fuertes in western Texas. Few animals possess more wonderful protective markings than these bar-tailed lizards. As they dash away, well up on their legs, with tail curled over the back, exposing their brightly colored sides and the black and white barred lower surface of the tail, they are strikingly conspicuous, until, stopping suddenly, they flatten themselves on the ground, when the speckled back blends into the earth colors and the lizards are lost to view.

Holbrookia propinqua B. & G. Long-tailed Holbrookia.

There are 15 specimens of this slender-tailed Holbrookia from five localities in southern Texas: Brownsville, Sauz Ranch, Santa Rosa Ranch and Padre Island in Cameron County, and King's Ranch in Nueces County.

Holbrookia maculata Girard. Spotted-sided Holbrookia.

The collection contains 19 specimens of this little, short-tailed lizard from the following eight localities in Texas: Mouth of Devils River, Fort Stockton, Fort Davis, Alpine, Paisano, Dimmitt (45 miles south), Henrietta, and Amarillo, places lying some in Upper and some in Lower Sonoran zones of the arid and the semiarid regions. Apparently the species has not been taken south of Devils River and San Antonio.

Holbrookia maculata lacerata Cope. Spotted-tailed Holbrookia.

One specimen of the spotted-tailed lizard from Cotulla, two from 15 miles west of Japonica, and one from 25 miles southwest of Sherwood considerably extend the southern and western range of the species. Apparently it belongs to Lower Sonoran zone.

Uta stansburiana B. & G.

Specimens of this little lizard from El Paso, Pecos City, and Fort Stockton carry its range across the extremely arid part of Lower Sonoran zone in western Texas and mark the eastern limit of a widely distributed species.

Uta ornata B. & G.

Twelve specimens of this little lizard are from the following localities in western Texas: Mouth of Pecos, Langtry, Ingram, Chisos Mountains, Altuda, Paisano, and Fort Davis. The Chisos Mountain specimen was taken at 6,000 feet, and the four Fort Davis specimens at approximately 5,700 feet, in the midst of Upper Sonoran zone. Altuda, Paisano, and Ingram are at the lower edge of the zone, while

Langtry and mouth of Pecos, as well as the type locality of the species, Devils River, are just below the edge in Lower Sonoran. However, enough Upper Sonoran species of plants cling to the cold walls of side canyons in the Langtry, Pecos, and Devils River country to account for the presence of such rock-dwelling species, and I am inclined to consider the range of this lizard as strictly Upper Sonoran, at least in Texas. If all the southern Arizona and California records of the species are correct, it is certainly Lower Sonoran in that region.

Sceloporus torquatus poinsettii (B. & G.).

This splendid, big, scaly rock lizard is represented in the collection by 14 specimens from the following localities in western Texas: Japonica, East Painted Cave, Marathon (50 miles south), Chisos Mountains (6,000 feet), Paisano, Davis Mountains (5,700 feet), Fort Stockton, Castle Mountains, near Toyah, and Guadalupe Mountains (south end of Dog Canyon, at about 6,700 feet). The species ranges throughout the width of Upper Sonoran zone, but in many places comes well into Lower Sonoran, as at Toyah and Fort Stockton.

Sceloporus clarkii B. & G.

The collection contains but 4 Texas specimens of this big scaly lizard—3 from Boquillas and 1 from Langtry. Both localities are on the Rio Grande, in extremely arid Lower Sonoran zone.

Sceloporus spinosus floridanus (Baird).

Eighteen specimens of this medium-sized *Sceloporus* from southern Texas come from the following localities: Seguin, Ingram, Brownsville, Rio Grande City, Lomita Ranch (6 miles north of Hidalgo), Devils River, Langtry, and Pecos River (50 miles from mouth), which carry its range across the State in Lower Sonoran zone.

Sceloporus consobrinus B. & G.

Six localities in Texas are represented by the 8 specimens of this medium-sized *Sceloporus:* Joaquin, Sour Lake, Kerrville (Lacey's Ranch), Santa Rosa (Cameron County), Langtry, and Fort Davis. The range of the species apparently covers nearly the whole State where there are trees, in both Upper and Lower Sonoran zones.

Sceloporus dispar B. & G.

Lloyd collected 5 specimens of this little slender *Sceloporus* at Lomita Ranch, 6 miles north of Hidalgo, in June, 1891.

Sceloporus merriami Stejneger.

This beautiful little *Sceloporus*, which Doctor Stejneger has just described as new,[a] is represented by 5 specimens, 2 from the East

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[a] Proc. Biol. Soc. Washington, XVIII, p. 17, Feb. 5, 1904.

Painted Cave, near the Rio Grande, a mile below the mouth of the Pecos: 1 from Comstock; 1 from the Pecos River Canyon, 55 miles northwest of Comstock, and 1 from Boquillas, in the Great Bend of the Rio Grande. Apparently the species is confined to the rocky walls of the canyons of the Rio Grande and Pecos rivers.

Phrynosoma cornutum (Harlan). Horned Toad.

This commonest and longest-horned species of the Texas horned toads is represented by specimens from El Paso, Grand Canyon of Rio Grande, Alpine, Altuda, Valentine, Davis Mountains (east base), Toyahvale (20 miles southeast), Fort Stockton, Fort Lancaster, Painted Caves, Carrizo, Roma, Rio Grande City, Sauz Ranch (Cameron County), King's Ranch (Nueces County), Corpus Christi, Center Point, Llano, Dimmitt, Henrietta, and Tascosa, and from Antioch and Virginia Point in eastern Texas, a series of localities covering at least the whole arid Lower Sonoran zone of the State and extending irregularly into the humid eastern division. Considerable variation however, appears within this range. The three specimens from Virginia Point and one from Antioch are much darker than any of the others, with sharply marked face bars and gray, thickly spotted bellies, while those of the upper Rio Grande Valley, El Paso, and Rio Grande Canyon are the lightest and brightest colored of all, with narrow face bars and white bellies. The transition from these extremes is gradual across the State, but the dark individuals from the eastern localities, the gray ones from the grassy plains, the strongly marked ones from the Pecos Valley, and the paler specimens from the Rio Grande Valley, indicate color forms comparable with the subspecies of horned larks found breeding in regions of corresponding differentiation.

Phrynosoma hernandesi (Girard).

This rusty-brown horned toad with short, stubby horns is represented in the collection by a single specimen from Texas, collected at about 7,000 feet altitude in the southern end of the Guadalupe Mountains. Farther north it is abundant in Upper Sonoran and Transition zones.

Phrynosoma modestum Girard.

Anota modesta of Cope and others.

Specimens of this little gray, short-horned horned toad from the west base of the Davis Mountains, 40 miles south of Alpine, 20 miles northwest of Toyah, Salt Valley, at west base of Guadalupe Mountains, and Big Springs carry the range of the species well over the arid region of western Texas in a series of localities where Upper and Lower Sonoran species are more or less mixed. Apparently the species belongs to Lower Sonoran zone and extends to its extreme upper limit.

A specimen from the west base of the Davis Mountains is rusty brown instead of ashy gray, like those from other localities, a peculiarity of coloration agreeing with the brown *Crotalus lepidus* from this lava soil region.

Coleonyx brevis Stejneger. Gecko.

A single specimen of this odd little brown and yellow lizard was collected by Merritt Cary at Sheffield, August 9, 1902.

Ophisaurus ventralis Linn. Glass Snake.

The glass snake is represented by two specimens from Texas, one collected by Lloyd near Santa Rosa, Cameron County, and the other by H. P. Attwater and W. H. Rawson, 3 miles north of Kerrville. These localities help to fix a western limit for this legless lizard of the Lower Sonoran zone of the Southeastern States.

Gerrhonotus liocephalus infernalis (Baird).

A single specimen of this glassy smooth lizard was collected in the Chisos Mountains at approximately 6,000 feet altitude in Upper Sonoran zone. It was nosing about in the dry leaves under scrub oaks on the mountain side in the manner peculiar to the individuals of the genus.

Cnemidophorus tessellatus (Say). Whip-tailed Lizard.

This species is represented by specimens from Boquillas, Langtry, Fort Stockton (35 and 45 miles west), Castle Mountains, Monahans, and Van Horn, all of which localities lie in the extremely arid Lower Sonoran zone of western Texas. They mark the eastern limit of the known range of the species.

Cnemidophorus perplexus B. & G.

Two specimens of this species were collected by Cary, one at Pecos and one 4 miles west of Adams, in Pecos County. Both localities are in Lower Sonoran zone.

Cnemidophorus sexlineatus (Linn).

The collection contains specimens of this eastern species of the whip-tailed lizard from Waskom, Long Lake, Nacogdoches, Henrietta, Canadian, and Padre Island.

Cnemidophorus gularis B. & G.

This seems to be the commonest and most widely distributed of the whip-tailed lizards in Texas. There are specimens from Brownsville, Lomita Ranch (Hidalgo County), Rio Grande City, Roma, Carrizo, Cotulla, San Diego, near Alice, Corpus Christi, Cuero, Kerrville, Fort Lancaster, Fort Stockton, Devils River (near mouth), Comstock, Painted Caves, Paisano, and Marfa, and up the Pecos Valley in New Mexico to Santa Rosa and Ribera. Among these localities Ribera is the only one fairly out of Lower Sonoran zone.

Leiolopisma laterale (Say).

Specimens of this little slender Eumeces-like lizard from Waskom, in northeastern Texas, and from Velasco, near Columbia and near the mouth of Navidad River in southeastern Texas, do not extend the range of the species, which apparently covers all the eastern part of the State.

Eumeces quinquelineatus (Linn).

Hollister obtained a specimen of this species at Joaquin, near the eastern boundary of Texas.

Eumeces guttulatus (Hallowell). Skink.

Cary collected a specimen of this little skink at the east base of the Davis Mountains, 20 miles southwest of Toyahvale, at about 5,000 feet, and I took one at 6,800 feet in the south end of the Guadalupe Mountains, well toward the upper edge of Upper Sonoran zone.

Eumeces obsoletus (B. & G.). Skink.

A specimen of this larger skink was collected in the southern end of the Guadalupe Mountains, at 6,800 feet, in the same locality with the little *guttulatus*.

Eumeces brevilineatus Cope.

Lloyd collected a single specimen at Paisano "in a damp fernery at 5,300 feet." Cope records it from Helotes Creek (the type locality), on the front line of hills 20 miles northwest of San Antonio, and from near Fort Concho (across the river from San Angelo).[a] While these localities lie at the upper edge of Lower Sonoran zone the species, if an inhabitant of damp gulches, may well belong to Upper Sonoran.

Diadophis regalis B. & G. Ring Snake.

A specimen of this little spotted-bellied snake was collected in the Chisos Mountains at 5,000 feet, June 3, 1901. The two previously recorded localities for Texas—Fort Davis and Eagle Springs[b]—are both close to 5,000 feet and, like the Chisos Mountain locality, at the edge of Upper and Lower Sonoran zones.

Heterodon nasicus B. & G. Hog-nosed Snake.

Specimens of the hog-nosed snake from Cameron County (El Haboncillo), Sycamore Creek, North Llano River, Washburn, and Amarillo carry its range over the whole north and south length of the State through Lower and Upper Sonoran zones in the semiarid region. It is not a common or conspicuous species, and with the exception of the specimens collected, I have not seen it in Texas.

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[a] Ann. Rep. U. S. Nat. Mus. for 1898 (1900), p. 665.

[b] Ibid., p. 745.

Heterodon platirhinos Latreille. Blow Snake.

A single immature specimen collected by Lloyd, at Matagorda, does not add much to our knowledge of the range of the species, which apparently covers eastern Texas and reaches west to the Pecos and Devils rivers. All the Texas records are from Lower Sonoran zone, but farther east the species also ranges across at least Upper Sonoran.

Opheodrys æstivus (Linn.). Rough Green Snake.

The little green snake is represented by 3 specimens from Corpus Christi, Kerrville, and Rock Springs. From a range over the whole eastern or humid division of Lower Sonoran zone the species apparently reaches in Texas its western limit. It does not enter the plains region nor the arid region except where brushy gulches enable it to cross the rough country south of the lower arm of the Staked Plains. The specimens from near Kerrville and Rock Springs were taken in gulches with such vegetation as pecan, sycamore, elm, black cherry, oak, and abundant underbrush.

Liopeltis vernalis De Kay. Smooth Green Snake.

A specimen of the little smooth green snake was collected at Washburn by Gaut in July, 1904.

Bascanion flagellum Shaw. Whip Snake.

The coach whip or whip snake is represented in the collection by specimens from Matagorda, Matagorda Peninsula, Padre Island, and the Chisos Mountains, and by a flat skin from Devils River. While apparently distributed over the whole State, the species is most abundant, or at least most frequently seen, in the half brushy, half open arid region, where it is one of the commonest snakes.

Bascanion ornatum B. & G.

Two specimens of this rare species were collected in Texas, one at the head of Devils River, by Cary, the other on the Rio Grande, 8 miles south of Comstock, by Hollister, both in July, 1902. Hollister wrote on the back of the label of his specimen, "Up in bushes."

Cope records the species from two localities only, "Western Texas" and "Howard Springs, Texas."[a]

Drymobius margaritiferus (Schlegel).

Lloyd collected a single specimen of this species at Brownsville on July 17, 1891.

Callopeltis obsoletus (Say). Pilot Snake; Mountain Black Snake.

A specimen was collected by Lloyd, near the mouth of the Nueces November 21, 1891, and another by Gaut, near Sour Lake, April 1, 1905.

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[a] Ann. Rep. U. S. Nat. Mus. for 1898 (1900), p. 814.

rchon corais melanurus Dum. & Bibr.

[illegible] collected a specimen of this Mexican black snake at Browns- [illegible] July [illegible], [illegible].

his sayi (Schlegel). Prairie Bull Snake.

[illegible] snake is represented in the collection by 3 speci- [illegible] Comstock (20 miles north), and Paisano, and by a [illegible] head of Dog Canyon, in the southern Guada- [illegible] It is common over at least middle and northern [illegible] Lower and Upper Sonoran zones. In a prairie dog town [illegible] unusually large individual, measuring 7 feet [illegible] It was about 3 inches in diameter, large enough [illegible] swallowed a full grown prairie dog. Near Rock [illegible] smaller individual was found in the act of swallowing a [illegible] squirrel (*Citellus m. [illegible]*).

opeltis getula holbrooki Stejneger. King Snake.

[illegible] collected two specimens at Matagorda in January and Feb- [illegible] and I collected one at Arthur in June of the same year.

heilus lecontei B. & G.

[illegible] specimen of this beautiful yellow and black ringed [illegible] about 30 miles west of Rock Springs, where a [illegible] Sonoran [illegible] up into the Upper Sonoran plain. It [illegible] trusted, the [illegible] over the [illegible] Lower Sonoran zone of Texas.

actis episcopus isozonus Cope.

[illegible] specimen of this little [illegible] collected in the [illegible] M[illegible] Upper Sonoran zone.

fasciata transversa Hallowell.

[illegible] from Lampasas, the N[illegible] R[illegible] River, the Pecos River [illegible] Carlsbad, N. Mex. [illegible] for the [illegible] of Texas [illegible] Lower Sonoran [illegible]

clarkii B. & G. [illegible]

[illegible] specimen of the [illegible] at Caranchua [illegible] at the National M[illegible] gorda, including [illegible]

The following letter from Mr. Mitchel accompanied the specimen and 8 of the well-developed embryos:

> This snake was captured with 3 others in a salt marsh on Carrancahua Bay, Calhoun County. It took to the salt water freely. One had 4 small mullets in its stomach, another some fiddler crabs. The other inclosure is part of the womb of one of the snakes, showing embryos. She had 4 on one side and 10 on the other, 14 in all.

Storeria dekayi Holbrook.

Lloyd collected a specimen of this little brown snake at Barnard Creek, west of Columbia, March 4, 1892, and Gaut collected one at Sour Lake, March 14, 1905.

Eutainia elegans marciana (B. & G.). Garter Snake.

There are specimens of this plain little striped snake from Brownsville, Santa Rosa Ranch (Cameron County), Corpus Christi, Victoria, Seguin, Sycamore Creek, Devils River, Paisano, and Boquillas. It is the common garter snake of the whole arid Lower Sonoran zone of western Texas, apparently reaching its eastern limit at Victoria.

Eutainia proxima (Say). Spotted Garter Snake.

The collection contains 12 specimens of this garter snake from Brownsville, Lomita Ranch (Hidalgo County), Sycamore Creek, Corpus Christi, and San Antonio River, near San Antonio. The species apparently has a wide range, including most of Texas.

Eutainia cyrtopsis Kennicott.

One specimen of this beautiful garter snake with black nuchal spots was taken in the Davis Mountains, July 12, 1901, at about 5,700 feet, in Upper Sonoran zone.

Tropidoclonium lineatum Hallowell.

Gaut collected a specimen of this little striped snake at Hempstead, February 28, 1905.

Tantilla gracilis B. & G.

I collected a specimen of this tiny brown snake at Lacey's Ranch, near Kerrville, May 5, 1899. The species has been recorded from various localities in eastern and southern Texas in Lower Sonoran zone.

Elaps fulvius (Linn.). Coral Snake.

Four specimens of the coral snake from Brownsville, Corpus Christi, Cleveland, and Kerrville nearly double the list of definite localities for the State. Cope records the species from Indianola, San Diego, Fort Clark, and Hempstead, but his records for Cameron County, Rio Grande, and Rio Pecos are too indefinite for practical purposes in outlining distribution. A live specimen sent to Doctor *Stejneger* from Beaumont, December 4, 1903, carries the range of the species nearly across the State in both humid and arid Lower Sonoran zones, but the Cleveland and Beaumont specimens are much darker and richer in coloration than those from farther west.

Fortunately this is not a common species in Texas. I have found it but once in the State. From its beautiful colors and harmless appearance it is likely to be handled carelessly, and its bite is dangerous.

Agkistrodon piscivorus (Lacépède). Cottonmouth; Water Moccasin.

A single specimen of the water moccasin, collected by William Lloyd at the mouth of Devils River, September 24, 1890, slightly extends the known range of the species. (Indianola and Eagle Pass are the westernmost records given by Cope.[a]) A specimen collected in the Big Thicket of Liberty County was lost, but I could not have been mistaken in its identity.

Agkistrodon contortrix (Linn.) Copperhead.

A specimen of the copperhead collected by H. P. Attwater near San Antonio and three others collected near Kerrville, Arthur, and Sour Lake help to fill out the range of the species in the State. Cope records it from Cook County, Sabinal, and between Indianola and San Antonio.[b] All of these localities are in Lower Austral zone.

Sistrurus catenatus consors (B. & G.). Massasauga.

There is a single specimen of the massasauga in the Biological Survey collection, from Santa Rosa, Cameron County, Tex., collected by Lloyd in 1891.

Crotalus horridus Linn. Eastern Rattlesnake.

Gaut collected a specimen of this rattlesnake in the Big Thicket, 8 miles northeast of Sour Lake, April 1, 1905.

Crotalus atrox B. & G. Western Diamond Rattler.

This, the largest of the Texas rattlesnakes, ranges throughout at least the arid part of Lower Sonoran zone of Texas. In the collection there are specimens from Corpus Christi, Japonica, Devils River, Comstock, Sycamore Creek, Eagle Pass, Langtry, and Boquillas, and from as far up the Pecos Valley as Santa Rosa, N. Mex. Mr. Cary also saved a flat skin from Pecos, Tex., and Doctor Fisher one from Colorado, Tex. Specimens recorded by Cope[c] from Indianola, San Antonio, and Brazos River apparently mark the eastern border of the known range of the species. I have never found it in eastern Texas.

Throughout its Texas range this is the commonest rattlesnake.

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[a] Ann. Rep. U. S. Nat. Mus. for 1898 (1900), p. 1135.

[b] Ibid., pp. 1137 and 1138.

[c] Ibid., p. 1166.

While it is often reported as excessively abundant, I have nev
more than a dozen individuals in a season's field work of fou
months in its favorite haunts. Over most of the range we dc
more than an average of one or two in a month's field work.
18-days' camping and collecting trip—April 24 to May 11,
from Corpus Christi to Brownsville and return, we saw o
rattlesnakes, where we had been led to expect hundreds; and
region of dense cactus beds and thorny thickets they find perf
tection and probably reach their maximum abundance. Spe
from extreme southern Texas are reported by the residents as
ing a length of 11 to 13 feet; but the largest specimen I ha
alive measured only 50 inches in length.

Crotalus confluentus Say. Plains Rattlesnake.

This small, dull-colored rattlesnake is represented in the Bic
Survey collection from Texas by one specimen from Amarillo,
Staked Plains, in Upper Sonoran zone. I am familiar wi
species on Upper Sonoran plains of New Mexico and Nebras
have not found it elsewhere in Texas. The specimen collec
Captain Pope (No. 4962, U. S. N. M.), and labeled "Pecos
Texas," has not even a date by which to locate the place
obtained; but as it is well known that Captain Pope's specime
the top of the Staked Plains on the east and from the Gua
Mountains on the west were labeled "Pecos River," this rec
have no zonal significance. The specimen recorded by Cope
San Antonio, Tex., is entered in the Museum catalogue as c
"between San Antonio and El Paso," and the one recorded fr
San Pedro (Devils River) is catalogued from "between Ash
and Rio San Pedro." Mr. Brown's record for Pecos,[b] base
specimen collected by Meyenberg, can not, as Mr. Brown adn
used for "minute zone work," as Meyenberg's specimens, whi
to have been collected somewhere "within a day's journey by t
Pecos," may have come from much farther away. In 1902, at
75 miles northwest of Pecos, I met one of his men bringin
wagonload of live animals, among them numerous snakes and
which had been collected along the base of the Guadalupe Mou
mainly in Upper Sonoran zone, but probably also in Transitio
these specimens apparently were sent out as collected at Pe
Lower Sonoran zone, the difficulty of using Meyenberg's mate
zonal work is apparent.

Crotalus molossus B. & G.

This is the common rattlesnake of the Guadalupe Mount
Upper Sonoran zone on both sides of the Texas and New Mexi

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[a] Ann. Rep. U. S. Nat. Mus. for 1898 (1900), p. 1172.

[b] Proc. Acad. Nat. Sci. Phila., 1903, p. 551.

Specimens were collected near the edge of Transition zone on the east and west slopes of the mountains at 6,300 and 6,800 feet, but I assume that the species belongs to Upper Sonoran. A flat skin collected by Cary at a point 25 miles west of Sheffield is apparently this species.

We found this snake in August, 1901, in the gulches high up on the range. It is pugnacious, quick to sound its rattle and throw itself on the defensive. Because of its prevailing color of olive green, we always referred to it in the field as the "green rattlesnake."

Crotalus lepidus Kennicott.

Five specimens of this little rattlesnake from western Texas, the mouth of the Pecos, Paisano, Chisos Mountains, and Davis Mountains, indicate a range confined to the most arid and rocky part of the State in both Upper and Lower Sonoran zones. The specimen from the mouth of the Pecos was in Lower Sonoran zone on the gray limestone ledges at the east end of the High Bridge. In color it is pale ashen gray, with the pattern faintly indicated in dusky lines. The color has not changed materially in the alcoholic specimen from that of the live animal collected May 20, 1900, when I called it the 'white rattlesnake' to distinguish it from anything previously known to me. Mr. Cary reports several seen on limestone ledges along the Pecos Canyon at Howard Creek and Sheffield, all of which were whitish in color like the lime rock on which they were found. One specimen from the Chisos Mountains at about 6,000 feet, one from Paisano, and two from 5,700 feet in the Davis Mountains, were all taken in Upper Sonoran zone. Others were seen in both the Chisos and Davis mountains at similar altitudes, but none lower. All of these specimens in life or when freshly killed, and the others seen but not collected, were dark rusty brown with a pinkish tinge, heavily marked with velvety black crossbars. The brown has faded considerably in the alcoholic specimens, as shown by comparison with a careful color study of the fresh snake made in the field by L. A. Fuertes.

These little brown rattlers were fairly common about our camp near the head of Limpia Creek, in the Davis Mountains. On the dark brown lava soil they were very inconspicuous, and they had a way of suddenly springing up between our feet that made us slightly nervous.

REPORT ON THE MAMMALS OF TEXAS.

The following report on the mammals of Texas is based mainly my own field notes and those of the other members of the Biolog-al Survey who have worked in the State, supplemented by records om local naturalists and ranchmen.

Tatu novemcinctum texanum subsp. nov. Texas Armadillo.

Type from Brownsville, Tex., No. $\frac{134452}{46438}$ ♂ ad., U. S. Nat. Mus., Biological Survey Coll. Collected by F. B. Armstrong, June 10, 1902; original No. 4.

General characters.—Similar to *mexicanum* from Colima, but with relatively heavier dentition, larger and more acutely triangular lachrymal bone, and with larger epidermal plates on forehead and wrists.

Measurements of type.—Total length, 800; tail, 370; hind foot, 100. Skull of type: Basal length, 81; occipito-nasal length, 100; nasals, 36; greatest zygomatic breadth, 43; mastoid breadth, 29; alveolar length of upper molar series, 27; of lower molar series, 27.

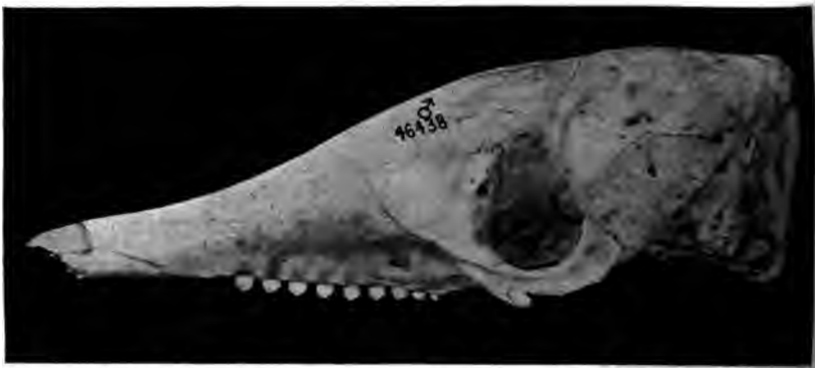

FIG. 5.—Skull of armadillo (*Tatu novemcinctum texanum*) from Brownsville, Texas. (Natural size.)

Specimens examined.—Brownsville, 12; El Blanco, near Hidalgo, 1; Corpus Christi, 2; Nueces Bay, 1 skull; Kerrville, 2 skulls.[a]

Armadillos are common in southern Texas from the Lower Rio Grande to Matagorda Bay, the mouth of the Pecos, and north to Llano. A few are reported farther up the Pecos Valley, at old Fort Lancaster, Grand Falls, and Loving County, and one from 22 miles north of Stanton, while a specimen in the National Museum is labeled "Breckenridge." They have been taken in Burnet County and at Austin and Elgin, and reported from Inez, Seguin, Columbus, Navasota, and as far east as Antioch on Nevils Prairie. The belief is

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[a] A series of 9 specimens, collected at Colima, Mex., by Nelson and Goldman, agrees in respect to the small quadrate lachrymal and light dentition with the excellent figure of a skull of *Tatusia mexicana* (Pl. II, fig. 3) in Gray's Hand List of the Edentate, Thick-Skinned, and Ruminant Mammals in the British Museum. As no locality more definite than Mexico is assigned to either the type of *Dasypus novemcinctus* var. *mexicanus* Peters or the specimen figured by Gray, the type locality may be fixed by considering the Colima specimens typical. The exact relationship between *mexicanum* and ***novemcinctum***, of Brazil, remains to be worked out.

[illegible] that they are spreading eastward and northward, but whether [illegible] founded on a real extension of range or on an increase [illegible] throughout an established range is not entirely settled [illegible].

[illegible] reported armadillos as rare on Raglans Ranch, 32 [illegible] of Eagle Pass, where two had been taken within ten [illegible]. Lloyd reported them as common north of Browns[illegible] sought after for eating purposes." One taken at [illegible] miles southeast of Hidalgo, he says, "was very ten[illegible] gamy smell," and he adds, "they eat small coleop[illegible] greater quantities of the latter." He says that a cow [illegible] near the center of Padre Island, and at Nueces [illegible] he reported finding the remains of one and traces where others [illegible] digging.

[illegible] reported [illegible] the rivers at [illegible] M[illegible] creek [illegible] at a [illegible] the Mexican [illegible] creeks at [illegible] at [illegible] Rock Springs [illegible] of Fort [illegible] Independence Creek [illegible] Pecos High Bridge [illegible] at Del R[illegible] at Comstock [illegible] occasional occurrence at Austin, where one was taken a few years ago, and as rare at Elgin, where there are well-authenticated instances of their capture along some of the creeks.

Near Antioch, Houston County, in 1902, Hollister obtained two records of the capture of armadillos on Nevils Prairie, the last about 1899, where one wandered into a smokehouse and was caught and kept alive for some time. Cary in his reports for 1902 records the capture of an armadillo by John Hutto, a sheep man living 22 miles north of Stanton, in 1892. Mr. Finnegan, the hotel proprietor at Stanton, saw the animal at the time. At Monahans Cary was told by Landlord Holman that armadillo shells were rarely found in the sandhills, but that he had seen a specimen killed at Grand Falls in 1899. In February, 1902, Mr. Royal H. Wright, of Carlsbad, N. Mex., wrote me that he had picked up an old armadillo shell in Loving County, Tex., close to the New Mexico line. At Llano, in 1899, I was told that armadillos were frequently killed around there or brought into town alive. In 1904 a few armadillos were reported at Seguin, and Mr. Samuel Neel told me that a few years ago he had found one in the garden under the vines of his cowpeas. At Columbus Mr. Henry Mathee told me of two armadillos killed there during the fall of 1904, and Mr. J. F. Leyendeker wrote me that one was taken near Frelsburg. At Navasota Mr. Charles Hardesty told me of one caught near there during the summer of 1904. In a letter of June 4, 1904, Mr. H. P. Attwater furnishes the following note:

> When in Port Lavaca last week I obtained some notes in regard to armadillos which may be of interest. Mr. J. M. Boquet, a very intelligent and reliable ranchman, says that these animals were first noticed in Calhoun County in 1886 or about that year; that they are now very common, and that he has no doubt there are hundreds of them in the county to-day. He says their favorite resort on the prairie ranches is in the long Cherokee-rose hedges, which have been grown in many parts of that and adjoining counties as a wind-break in winter for cattle. During the last few years since armadillos have become so common in the southwest and south central Texas I see baskets made of armadillo skins or shells in the curio stores at San Antonio and other places. The legs are cut off and the tail fastened to the mouth, forming the handle of the basket. At a curio shop in San Antonio two or three days ago I was informed that they sold for about $1.50 to $2 each.

The armadillos are strictly Lower Sonoran, but in the rough country between Rock Springs and Kerrville they range fairly into the edge of Upper Sonoran Zone. As a rule they do not extend east of the semiarid or mesquite region, nor to any extent into the extremely arid region west of the Pecos, but occupy approximately the semiarid Lower Sonoran region of Texas, north to near latitude 33°. They are partial to low, dense cover of coarse grass, thorny thickets, cactus patches, and scrub oaks, under which they make numerous burrows and trails, or root about in the leaves and mold, where they enjoy parative safety under the double protection of leafy screen and or plate. But they thrive best in a rocky country, especially ere limestone ledges offer numerous caves and crevices of various s, from which they can select strongholds that will admit no ger animal. Almost every rock-walled gulch along the headters of Guadalupe River has one or more dens with smoothly worn rways from which much traveled trails lead away through the hes or to little muddy springs, where tiny hoof-like tracks and the rugated washboard prints of ridged armor suggest that the arma- os not only dig and nose about in the soft ooze for their insect d, but, pig-like, enjoy also a cooling mud bath. Other trails lead ng rocky shelves, up the sides of gulches, and away from thicket hicket, and are easily followed sometimes for half a mile till they nch and scatter or connect with cattle trails, where the rope-like nts of dragging, horny tails are visible among the dusty cow cks. Late in the afternoon one occasionally meets an armadillo tting vigorously along a trail on his stumpy little feet, his tail

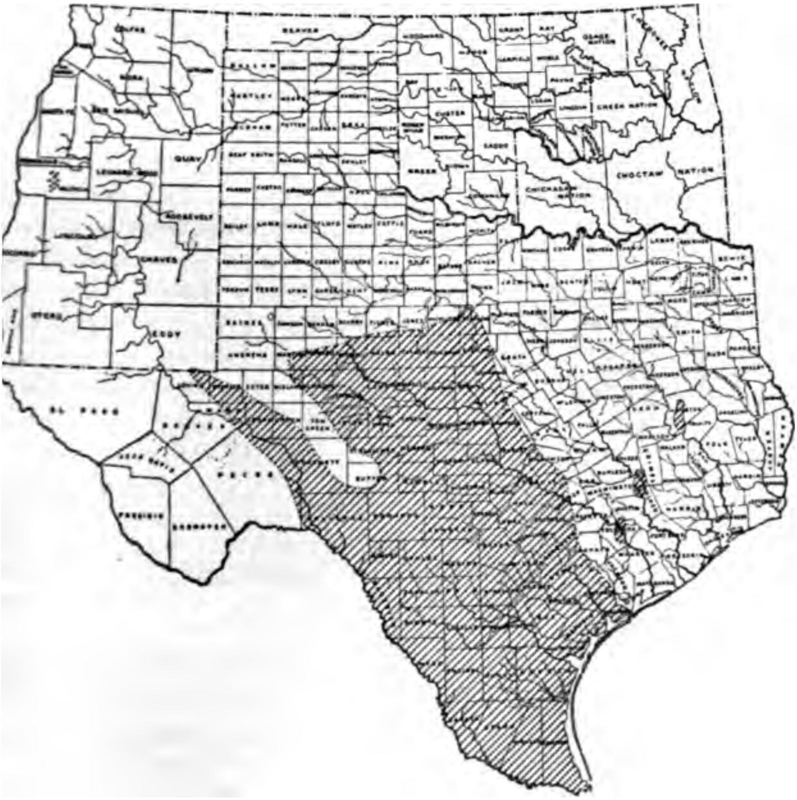

FIG. 7.—Distribution area of armadillo (*Tatu novemcinctum texanum*).

dragging after him in a useless sort of way as he hurries nervously across the open spaces and stops in the thickets to nose about under the leaves in search of dainties from the fragrant soil. At such times the long, pointed nose seems to be the keenest organ of sense. The little eyes, half the time buried in rustling leaves, rarely detect an object not close by and in motion. I have followed one of these preoccupied little animals for half an hour, often within 20 or 30 feet, moving only when it was rustling in the leaves, and watching its motions without being discovered or creating alarm. Hunters say that if you stand still the armadillos will sometimes bump against your feet without discovering you, so short sighted are they and so intent on their own business. But when alarmed, they get over the ground with a rush that is surprisingly rapid considering their turtle-like build. If the first rush does not carry them to cover and an enemy overtakes them, they curl up in an ironclad ball that is not easily uncurled. In autumn, during the deer hunting months, when the young of the year are full grown, they are especially numerous and particularly obnoxious to the still hunters, who repeatedly mistake their rustling in the leaves for the noise of feet of bigger game. Where a dozen or twenty armadillos are met in a day's hunting, as sometimes happens, and possibly no deer are seen, the nervous strain and disappointment on the part of the hunter sometimes result in serious consequences to the innocent armadillo.

The excrement of the armadillos found scattered along the trails in the form of clay marbles and with the texture of baked mud gives some clue to the food habits of the animals. Careful examination shows only the remains of insects, mainly ants and a few small beetles, embedded in a heavy matrix of earthy matter.

Didelphis virginiana Kerr. Virginia Opossum.

Specimens of opossums examined from northern and middle Texas, Gainesville, Vernon, Brazos, Mason, and Kerrville, have the light-gray coat, white ear tips, and comparatively short tail of *virginiana*. To the west the species does not extend much beyond the one hundredth meridian, except along some of the stream valleys, up which it reaches as far as San Angelo, Colorado, and Tascosa. I have seen no specimens from extreme eastern Texas, except from near the coast, where they are referable to *pigra*.

The Virginia opossums are more or less abundant throughout their range, and live mainly in the woods and brush along streams. In the daytime they sleep in hollow trees or logs, in holes in the ground, or merely curled up in the brush or weeds or sometimes on a large branch of a tree, and if disturbed appear stupid and dazed. At night they prowl about in search of food, and, not being epicureans, usually find it in abundance. They are especially fond of chickens [illegible] eggs and do considerable mischief in the henhouse. They will eat any [illegible] of meat, even when it is old and stale, and often per[illegible] [illegible] into traps baited for more desirable game. Through [illegible] they feed extensively on fruit, and are usually lean and [illegible]. In the fall they become very fat and by many are then [illegible] a great delicacy. Their importance as food and game [illegible] the value of their fur make up for the inconsiderable [illegible] and then occasion poultry raisers. Winter skins in [illegible] are quoted at 55 to 60 cents, and they usually constitute [illegible] of the fur harvest of local trappers.

Didelphis v[illegible] pigra Bangs. Florida Opossum.

[illegible] of the opossum from the coast region of Texas east of Ma[illegible] Bay are generally a little darker than typical *virginiana*, [illegible] about the face. While not typical, they are nearer [illegible] to *virginiana*, from which there is no sharp line of [illegible]. They are merely the darker southern form inhabiting [illegible] the South Atlantic and Gulf coast region, with habit[illegible] [illegible] conditions and environment. On the coast prairies [illegible] Texas they live much in the open, wandering along [illegible] ponds and bayous, keeping under fallen grass or [illegible] feeding extensively on crawfish [illegible] In the stomach of one taken near Galveston [illegible] bird's feathers [illegible] seem abundant in the Big Thicket [illegible] caught them in a [illegible] He reports two [illegible] apparently [illegible] He [illegible] crawfish, one [illegible] maggots and [illegible]

Didelphis marsupialis texensis [illegible]

[illegible] a widely [illegible] from both [illegible] black ear [illegible] individual [illegible] southern part [illegible] San Antonio [illegible] Pecos [illegible] considers the [illegible] of both from San A[illegible]

[illegible] Allen refers [illegible]

[illegible] Mus Nat Hist [illegible]

[illegible] nearer to *pigra*

Bul. Am. Mus Nat Hist [illegible]

The habits of this opossum are peculiar only in so far as they have been modified to adapt it to the country in which it lives, a more or less open region of mesquite, brush, and cactus, with few hollow logs or stumps. For home and shelter the animals depend largely on burrows, which apparently they dig for themselves. In setting traps where fresh earth was being brought out of the burrow or out of several of a group of burrows each night, hoping to get a badger or armadillo, I have on several occasions been disappointed to find in my trap next morning only an old black opossum.

A female caught at Del Rio January 30, 1890, had nine tiny young in her pouch, each clinging to one of the slender teats and grasping the moist, crinkled, brown hair of the pouch lining with all four of its little hands. If forcibly pulled loose they would immediately regain their hold, the only instinct of their embryonic life being to hold on tight and get nourishment. They were too small to noticeably distend the pouch, and I discovered them only in preparing the specimen on the following day. I then noticed that the nine teats, arranged in two semicircular rows with one in the center, were not the full set. The anterior pair were functionless, but as the mother was not fully grown these probably would have developed with the next and larger litter of young. While in the trap this female showed no disposition to fight or defend herself, but an old male caught a day or two later fought viciously, growling and biting anything that came within reach, actually cutting deep gashes in the hard-wood stock of my gun. Another female, caught by James H. Gaut at the mouth of Sycamore Creek, 12 miles east of Del Rio, June 1, 1903, was carrying six very small young in the pouch.

Tayassu angulatum (Cope). Texas Peccary; Javeline; Musk Hog.

Peccaries are still more or less common in southern Texas and along the Rio Grande to above the mouth of the Pecos, thence up the east side of the Pecos Valley into the unsettled sandhill region of southeastern New Mexico, and east along the broken edge of the plains to San Angelo and Kerrville, and along the coast to Corpus Christi. A few may remain here and there still farther east and north, where they once ranged, but they have been pretty thoroughly driven out by the settlement of the country, and are now merely clinging to existence in regions of deep rocky canyons or dense thorny cactus and chaparral and in an uninhabited waste of sand dunes. They are extremely wary, depending for protection mainly on caves in the rocks and impenetrable cover, and so may be able to hold their own for a few years longer. They are usually hunted with dogs and horses, as it is almost impossible to discover or get near them in any other way. The cowboys occasionally rope one, but claim that many good horses are ruined by being ridden over boars, which never fail to cut and gash the horses' legs in a dangerous manner.

In October, 1904, I was told that a half-grown peccary in the San edro Park, at San Antonio, had been captured in Nueces County ithin a month.

The following reports by Merritt Cary were made in September, 902:

The peccary is common in Castle Mountains and on sand ridges northwest f there. Along Castle Gap I went into several caves beneath the rim rock

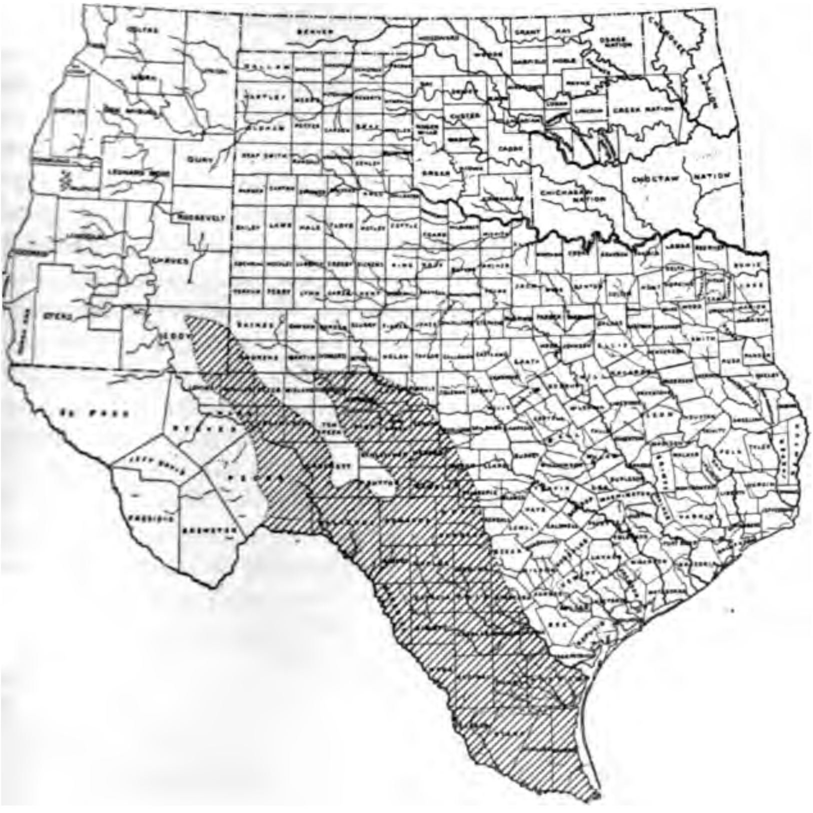

FIG. 8.—Distribution area of peccary (*Tayassu angulatum*).

nd found the ground all tramped up by them, where they had evidently made eir dens.

A peccary was killed 2 miles northeast of Odessa about September 1, 1902, ut was very thin and evidently a wanderer. The animals are said to be comon in the western portion of Gaines County.

Peccaries range throughout the sand along the Texas Pacific Railroad west about Quito station and east rarely as far as Odessa. North they follow e sand belt well up into New Mexico, according to report, while to the south eir range is continuous through the Castle Mountains and down the valley f the Pecos. From what I could learn, their center of abundance in the sand elt is some 10 to 15 miles north of Monahans, where the 'shinrick' is densest, nd their principal food, the acorns, most plentiful. They are said to hide in the 'cats-claw' (*Acacia*) during the day and range out into the sand hills for acorns at night or in cloudy weather. One was killed while we were at Hawkins's ranch, but the hide and skull were spoiled before we could secure them. Several peccaries have been killed at San Angelo in years past.

Cervus merriami Nelson. Merriam Elk.

There are no wild elk to-day in the State of Texas, but years ago, as several old ranchmen have told me, they ranged south to the southern part of the Guadalupe Mountains, across the Texas line. I could not get an actual record of one killed in Texas, or nearer than 6 or 8 miles north of the line, but as they were common to within a few years in the Sacramento Mountains, only 75 miles farther north, I am inclined to credit the rather indefinite reports of their former occurrence in this part of Texas. Specimens of horns and a part of a skull from the Sacramento Mountains indicate that the species was very similar to and probably identical with the Arizona elk described by E. W. Nelson who has aided me in making the comparisons.

In his field report for May, 1904, from the Wichita Mountains, Oklahoma, Gaut says:

> Mr. A. T. Hopkins, of Lawton, killed an elk in 1881 on Rainy Mountain, about 40 miles west of Lawton. This apparently is the last specimen recorded from that region. Several antlers have been picked up within the last few years on Rainy Mountain, a high ridge about 12 miles west of Mount Scott, and Mr. O. F. Morrisey, the forest ranger, informed me that he frequently runs across elk antlers while on his rides through the reserve.

In 1852 elk were reported[a] by Captain Marcy from the Wichita Mountains, Indian Territory, and if they ever were common there they would naturally at times have strayed across the interval of less than 50 miles to the border of northern Texas. This report may have led to the inclusion of 'moose' with the game of Texas in Mary Austin Holley's History of Texas, 1836, but it is by no means certain. The particular form of elk which inhabited the Wichita Mountains will probably never be known, although it may have been referable to *C. canadensis*.

That northern Texas is well adapted to elk is shown by the perfect condition in 1902 of a herd of nine owned by Mr. Charles Goodnight, of Goodnight, Tex.

Odocoileus virginianus texanus Mearns. Texas White-tailed Deer.

Specimens of the white-tailed deer from Corpus Christi, Kerr County, Rock Springs, and Langtry agree with the type and topotypes of *texanus* from Fort Clark, and indicate for this form a wide range over the semiarid part of southern and middle Texas, but do not in any way define the limits of its range. In the open and arid

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[a] Explorations of Red River of Louisiana, p. 186, 1854.

[illegible]st of the Pecos white-tailed deer are rare. The skull of an [illegible] from San Elizario, on the Rio Grande, just below El Paso, [illegible] large molars and large audital bullae, and can only [illegible] referred to *texanus*. The few once inhabiting the [illegible] Mountains have been almost exterminated, and [illegible] the little *couesi* instead of *texanus*. Excepting [illegible] Pecos region and, possibly, the open top of the [illegible] the whole of Texas is or has been occupied by some [illegible] tailed deer.

[illegible] specimens from Liberty, Hardin, and Jasper counties [illegible]stern Texas are apparently *texanus*, but more and better [illegible] from this region may show that they are nearer to [illegible] [illegible] certainly are not the large, dark *louisianus*, which, [illegible] considerations alone, they might be supposed to be. [illegible] region of Liberty and Hardin counties deer are [illegible], owing to the dense forest and the tangle of vines, [illegible], and canes which afford them almost impenetrable [illegible] are now hunted mainly with hounds, but formerly [illegible] night hunting with a headlight was the favorite [illegible] were wantonly slaughtered in great numbers. One [illegible] he had no idea how many deer he had killed for [illegible] that in the fall of 1886 he remembered selling 60 skins, [illegible] of which were left in the woods. Even at the [illegible] law in this region is rarely enforced, and [illegible] regard to season. With the [illegible] advantages offered [illegible] tracts of unoccupied forest and [illegible] land, [illegible] of acorns and other food, deer with [illegible] become abundant again.

[illegible] of about 250 pairs of [illegible] interesting, as all the [illegible] which is near the type [illegible] variation. [illegible] several sets, and a [illegible] yearling or imperfect [illegible] Sonora deer. The [illegible] photographs of a large [illegible] the collection [illegible]

[illegible] of the [illegible] four yearling [illegible]

[illegible] only [illegible]

examined July 15, 1902, and the nearly grown horns of the buck were in full soft velvet. All these deer were perfectly tame, and would push and crowd the Doctor as he fed them bran from a basin. Bran and hay constituted their main food. Though in good health and spirits they were thin, and I urged the Doctor to give them some of their natural food—the leaves of live-oak brush, acorns, mesquite and other bean pods.

On many of the large ranches between Corpus Christi and Brownsville, where the oak and mesquite thickets are interspersed with prairie and grassy openings, deer find ideal conditions, with abundant food and cover. The nature of the ground is such as to protect them from wolves and other natural enemies; but it is well suited to either hunting on horseback or still hunting, which, if freely allowed, would soon exterminate them. With protection, however, they increase rapidly, and in many places are abundant. Fresh tracks were common in the trails and even along the stage road in places, and the ranchmen usually know where to find a deer when needed. Similar conditions are reported over most of southern Texas, although varying greatly on the different ranches. From Kerrville west to Devils River and the Rio Grande deer are more or less abundant, both in the half-open mesquite valleys and over the rough juniper and oak-covered ridges. On certain large ranches they are still numerous, while on others they have become extremely scarce and would be entirely exterminated but for the recruits from surrounding and better protected ranches. Some of the ranchmen do not consider it worth while to protect the deer, while others leave the matter to indifferent foremen or else allow so much hunting by their friends that few of the animals escape. But such indifference is unusual. Almost every ranch gate we passed through bore the sign "Posted."

In spite of the protection of State laws and ranch owners there are still remote sections of rough, uncontrolled range where every year hunters kill wagonloads of deer for the market, or worse, kill the deer for the hides only, leaving the carcasses to rot. I was told that in the winter of 1901–2 hundreds of deer skins were brought out of the country west of Kerrville.

No part of the United States affords more perfect conditions for deer than southern Texas, and all that is required for their maintenance and rapid increase is efficient protection. In the past this has not been provided by the game laws; and the fact that the deer have not been wantonly destroyed over the entire region is due to the practical, business-like methods of the large ranch owners, who control the hunting on their ranges, and would as soon think of depleting their herds of cattle as the game under their control. On some of [illegible] ranches mounted rangers are regularly employed to ride the country and protect both stock and game, and to see that [illegible] are kept up and that there is no hunting. But usually this is [illegible] part of the business of the regular cowboys. As a [illegible] proposition the protection of deer can not be urged [illegible]. [illegible] presence on the range does not interfere with [illegible] horses. The deer rarely, if ever, eat grass or any [illegible] eaten by horses and cattle, but live on the leaves and [illegible], seeds, pods, and flowers of a great variety of plants, [illegible] and the pods of the numerous kinds of bean bushes. [illegible] private control of game was never more groundless [illegible] country where without such control the deer would [illegible] been exterminated over extensive areas where they are [illegible].

[illegible]eus macrourus? (virginianus) (Rafinesque). Plains White-[illegible] Deer.

[illegible] specimens of white-tailed deer from the sandhills 20 miles [illegible] Mobeetie, and 3 from Beaver Creek where it crosses the [illegible] Oklahoma line at the north edge of the Panhandle, are not [illegible] or *virginianus*. On geographic grounds they [illegible], described from the [illegible] plains of the K[illegible] [illegible] provisionally, at least, I refer them to this form.

[illegible] specimens from north of Mobeetie are fully adult [illegible] September 18, is in the pale yellow [illegible] coat [illegible] showing through [illegible] in full, fresh winter [illegible] corresponding sexes of [illegible] [illegible]. The doe [illegible] [illegible] of black or [illegible] [illegible] around the [illegible] [illegible] of *[illegible]*. [illegible] National Museum collect[illegible] [illegible] are in faded [illegible]. The three imperfect [illegible] agree in a general [illegible] M[illegible] [illegible] 1902, Merriam [illegible] the sandhill reg[illegible] [illegible] M[illegible] [illegible] pretty [illegible] [illegible] W. Cunningham [illegible] [illegible] A. H. H[illegible]

[illegible]

in small numbers in the brushy bottoms; and in July, 1904, Gaut reported them as common in the region about Mobeetie.

Odocoileus couesi Coues and Yarrow. Sonora Deer.

This little deer is the smallest of the white-tailed group found in the United States, an old buck rarely being estimated at over 100 pounds, while the does are variously estimated at from 50 to 75 pounds. The horns are small and closely curved in, with usually three or four points to a beam; the ears are considerably larger than in specimens of *texanus* weighing nearly twice as much. The young, after losing the spots, are light yellowish brown until after the change to the gray coat, which apparently takes place with the fall molt of the third year. The adults, after about two and a half years old, are light gray at all seasons, without black on ears or tail.

The species is widely distributed through the desert mountains of southern Arizona and northern Mexico and probably reaches its eastern limit in the Chisos Mountains of western Texas. Here these little deer range from 5,000 feet at the upper edge of Lower Sonoran zone through Upper Sonoran and Transition to the top of the mountains at 9,000 feet. They are closely associated with the oaks, junipers, and nut pines, and depend much on the cover of brush and timber. During the day they are usually found lying under a low, branching juniper tree or in a thicket of oak brush, and when started are more often heard bounding over the rocks than seen in the open. They are most numerous on the plateau top of the mountains, at 8,500 feet, where a steep 3,000-foot slope protects them from most hunters and where the sweet acorns of the little gray oak are abundant. Between rains the only water on this plateau is held in the rock basins, but it is usually ample for the needs of the deer. A few springs around the base of the mountains are permanent and always accessible in case of drought. The deer on the plateau are so little disturbed that they are often seen feeding or wandering about during the day. While sweeping the slopes with a field glass I often located deer and watched them without arousing their suspicion. At 11 o'clock one warm day I watched three does come down from an open sunny hillside and select cool beds in the shade of bushes along a deep gulch. At another time I watched a doe and two yearling fawns feed until they were satisfied and then scatter to make their beds under different trees on an open grassy slope. On several occasions, by moonlight, the flash of their white tails at close quarters was seen with startling effect, the gray bodies being quite invisible.

The food of the deer in June consisted mainly of leaves, flowers green seeds, and capsules or pods of a great variety of shrubs and plants, including the leaves of the little gray oak (*Quercus grisea*) and wide, flat pods of several bean bushes (*Acacia roemeriana* hers), leaves and berries of sumac (*Schmaltzia microphylla*), and capsules of a large *Pentstemon*, and flowers and stems of rass (*Nolina lindheimeriana*). The prints of the deer's teeth ften found on the half-eaten green stalks of the century plant (*wislizeni*). Much-used trails and abundance of winter among the oaks showed that acorns were the great attraction fall and winter. No trace of grass could be found in any of ee stomachs examined.

eus hemionus canus Merriam. Gray Mule-deer.

skins (with skulls) of mule-deer and 8 skulls (or horns with of skulls) from the region about Samuels, Langtry, and the

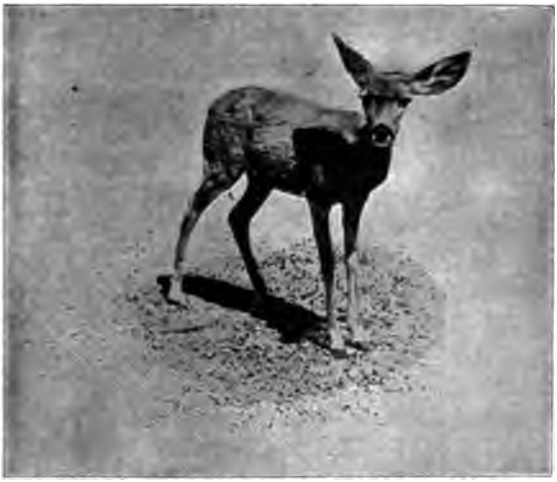

Fig. 9.—Yearling buck of gray mule-deer, Langtry, Texas.

of the Pecos River, a head and horns from Alpine, and a few rns from the Chisos Mountains agree in a general way with pe and topotypes of *canus*. The skins show the same light olor, and the skulls are small, the forehead flat, and the horns low and widespreading. I have seen no specimens from rthern end of the Staked Plains, but should expect the deer region to be *hemionus*. A skull of an old buck from the lupe Mountains north of the Texas line in the collection of H. Wright is not of the *canus* type; and a very large buck that at 8,500 feet on the side of Guadalupe Peak was of the full *hemionus*. In the outlying desert ridges west and south of nountains, where the deer are most abundant, the country is of the Lower Sonoran desert region inhabited by *canus*.

The mule-deer is still more or less common in many parts of western Texas, in the Guadalupe, Diablo, Franklin, Davis, Santiago, and Chisos mountains, and eastward to Devils River and the rough country along the east side of the Pecos River as far as Fort Lancaster and the Castle Mountains. A few are found in the deep canyons and gulches cutting into the edges of the northern part of the Staked Plains as far east as Washburn and Mobeetie, but it is much more probable that these range from the Rocky Mountains through the extremely rough country along the south side of the Canadian River than that they have a continuous range southward to meet those of the lower Pecos country. Still, it is not improbable that they range, or have ranged in the past, all along the east escarpment of the Staked Plains. None were found in the timbered part of the Chisos Mountains, but they were common in the barren foothills and outlying desert ranges at long distances from any known water. In the Guadalupe Mountains the same distribution was conspicuous, the mule-deer being far more numerous in the barren foothills on the west side of the range where no water has been found than in the high central timbered part. The deer apparently can go for a long time without water, getting an occasional supply from the rock basins after each rain, or, in cases of long drought, possibly making journeys of 20 or 30 miles to permanent springs. It is commonly believed by ranchmen and hunters, and on good grounds, that these deer can live indefinitely without water, getting all the moisture required from juicy plants. They eat the green stalks of the big century plants (*Agave wislizeni* and *applanata*) and paw open the cabbage-like caudex of the sotol (*Dasylirion texanum*) for its starchy and juicy center. Sheep are often herded on green feed for from three days to a month without water, and where there is snow, dew, or rain, for a much longer time. It is not strange that in a country where most of the springs are utilized for ranch use the deer should adapt themselves to desert conditions, especially as they offer them the greatest possible protection. In this open country, however, they are entirely at the mercy of hunters and unless protected by laws strictly enforced will be exterminated as soon as the country is settled.

At Langtry, in March and April, 1903, Gaut reported deer as "very plentiful a few years ago," and said:

> I visited the localities where old hunters claimed to have seen large numbers a few years back, and it is safe to say the large numbers are not there now. A young buck and a very large doe were seen. The heads of small rough canyons seem to be their favorite feeding grounds, and at this time of year they seem to feed to a great extent on the blossoms of *Yucca macrocarpa* and *Dasylirion texanum*.

At Mobeetie in 1904 Gaut was told by Mr. Long, a thirty-two-year [illegible] of the locality, that the only mule deer he could remember [illegible] that country was killed in 1896. In the Franklin M[illegible] February, 1903, Gaut reported a few mule deer, but [illegible] were scarce and very wild. On February 12 he saw the [illegible] buck at 4,500 feet altitude on the east slope of the [illegible] 10 miles north of El Paso.

Antilocapra americana (Ord). Antelope.

[illegible] by wagon from Ringgold Barracks to Corpus Christi [illegible] 1852, Bartlett found abundance of antelope on the [illegible] Texas. On January 1, 1853, he says of the prairie:

> [illegible] deer and antelope were scattered over it. Never before had [illegible]. Droves of mustangs also appeared. The deer and [illegible] grazing in herds of from ten to fifty, and [illegible] leisurely trotted off to a short distance and again stopped. [illegible] I was desirous of reaching Corpus Christi before night.

[illegible] antelope still remain, scattered over the plains of western Texas [illegible] west of the one hundredth meridian.

[illegible] were frequently seen along the stage road 30 miles [illegible] City and 10 miles north of Sterling, and [illegible] near Gail. Thirty miles north of Gail [illegible] tracks of others, and along the road to [illegible] several more small [illegible] many [illegible] near Tascosa, while [illegible] scattered over the [illegible] from [illegible] N. Mex.

[illegible] told me that a [illegible] where they were [illegible] 30 miles northwest of San Diego [illegible] southwest of [illegible] Rock Springs [illegible] 40 miles [illegible] entirely disappeared [illegible] Laredo and from the [illegible] a bunch of about [illegible] south of M[illegible] bunch [illegible] Langtry [illegible] M[illegible]. In 1890 [illegible] Marfa and the base of the D[illegible] M[illegible] had disappeared [illegible] controlled stock range [illegible]

[a] Bartlett's Pe[illegible] N[illegible]

In 1902 a few were said to be still found on the open plains north of Rock Springs, and a few on the plains between Valentine and the Davis Mountains, where Mr. John Finley reported 3 in his pasture. At Van Horn within a few years they had disappeared from the valley near the station, but a few were still found in the region farther back from the railroad. At Sierra Blanca, August 3, I saw 3 young antelope which had just been brought in and picketed near the station. Late in August, Hollister and I saw a fine old buck and tracks of a few others on the high plateau at the south end of the Guadalupe Mountains, and on October 2, Hollister saw two small bunches near the railroad between Dalhart and Texline In crossing the Staked Plains in September I saw from the train antelope near Hereford and 9 near Canyon City, and Mr. Goodnight told me that about 30, which until the previous year had been protected in his pasture, had escaped to neighboring ranches. Car obtained reports from resident ranchmen of a few on the mesas 1 miles east of Sheffield, of others a short distance to the northeast o Ozona, of a few to the west of Fort Stockton and in the vicinity o Grand Falls, and of others on the east and west sides of the Castl Mountains. He reported them as occasionally seen in the vicinity of Odessa, as common 25 to 50 miles north of Stanton and i smaller numbers 10 or 20 miles south of that place, and as occurring 15 miles north of Abilene, in Jones County. He reported also bunch of 10 or 12 on the plains 10 miles northwest of Clyde, and number in the vicinity of Pecos City, but mainly in fenced pastures where the stockmen protected them and strictly prohibited hunting

In August, 1903, Howell saw a bunch of 8 or 9 antelope on the prairie 15 miles west of Texline. In February of the same year Gaut reported a few in the valley east of the Franklin Mountains and was informed by Mr. Thomas Robinson, foreman of a large cattle ranch, that these antelope were being protected in one of the ranch pastures.

In 1904 Gaut reported antelope as still common on the plains near Washburn.

It is greatly to be hoped that the Texas State law prohibiting the killing of antelope for a period of five years will be extended indefinitely, as without it both the antelope in the open range and those on the big fenced ranches will soon be exterminated. In no other part of America, with the exception of the Yellowstone and a few private parks, can antelope be expected to last many years, and it i to be hoped for the credit of the State and nation that Texas wil protect them for all time.

Bison bison (Linn.). Buffalo: American Bison.

Buffalo once ranged over almost the whole of the present State *Texas*, and were exceedingly numerous from the coast prairies nort over the prairies and plains of the middle part of the State. They were slowly driven back until in 1870 their range, as defined by Doctor Allen,[a] was limited to the plains of the northwestern part of the State. In the next five years they were mostly killed or driven back to the top of the Llano Estacado, where a few remained in the northwest corner of the Pan Handle until 1889, when W. T. Hornaday estimated their number at 25.[b] In 1901 Oberholser was informed by local ranchmen that the last buffalo were seen in 1889 in the Devils River country, and that a few were seen 20 miles north of the mouth of the Pecos the same year. In 1903 Gaut found well-preserved skulls and skeletons of two bulls and a cow in a shallow cave about 10 miles east of Langtry, and saved the skulls for specimens.

In 1894 numerous reports were published in the local Texas papers and copied in Forest and Stream and other journals, describing a herd of buffalo variously estimated at from 30 to 60 head in Valverde County, near the Rio Grande. Later this herd was supposed to have crossed the river and disappeared in Mexico. These reports were shown by Mr. H. P. Attwater to be wholly fictitious.[c] Again, in 1897, a herd of about 80 was reported from Presidio County and the Great Bend of the Rio Grande. In 1901 I could find no one in the Great Bend country who had ever heard of buffalo in that region, nor could I find any evidence to indicate that they ever inhabited the extremely rough and arid country along that part of the Rio Grande Valley.

In 1902 Cary made the following report from Monahans, in the sand-hill region east of Pecos:

> Landlord Holman, of the Monahan Hotel, who is an old-timer here, informs me that the last buffalo in the sand-hill region was killed in the winter of 1885 by a professional hunter. George Causey, who is credited with having killed more buffalo than any other man in Texas. In the fall and summer of 1884 Causey killed several near the southeast corner of New Mexico, and finally, in January, 1885, while riding to Midland, came up with the last two remaining animals, a cow and calf, near the Water Holes. Causey shot the cow and roped the calf, which he finally turned over to Mr. C. C. Slaughter, of Fort Worth, who eventually had it killed for a large barbecue. From the same source I learned that the last bull buffalo in the San Angelo region was killed in the fall of 1883, in the southern part of Green County, by a Mr. Mertz, of San Angelo.

At Stanton, Cary says:

> I heard from a number of reliable sources that Will Work, who lived at Marienfeld (now Stanton) in the early eighties, killed several buffalo near the New Mexico line, in the western part of Gaines County, Tex., in the winter of 1885.

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[a] The American Bison, Living and Extinct: J. A. Allen. Geol. Survey of Kentucky, Vol. I, pt. 2, 1876.

[b] Extermination of the American Bison. W. T. Hornaday, Rept. U. S. Nat. Mus. 1889.

[c] Dr. J. A. *Allen in Bul.* Am. Mus. Nat. Hist., VIII, p. 53, April 22, 1896.

In 1899, while crossing the top of the Staked Plains from Gail to Amarillo and Tascosa, I found a few old, much-weathered buffalo horns, but the bones had mostly disappeared. In places the old deeply worn trails leading to water holes were a conspicuous feature of the plains, but where not kept open by range cattle they were heavily sodded over. Farther west on the slope, toward the Pecos River, the outcropping layers of soft limestone are deeply furrowed by hundreds of parallel trails trending toward the river valley. These are the last traces of the wild buffalo in Texas. The well-known herd of Mr. Charles Goodnight, at Goodnight, Tex., numbered in September, 1902, about 50 full-blooded buffalo and 70 crosses of various grades with polled angus cattle. The buffalo are in good condition, quiet and contented, breed freely, and are very hardy. The cows bear only full-blooded calves, and the crosses are made from buffalo bulls to polled angus cows, and then from these half-bloods to three-quarters and seven-eighths buffalo and to three-quarter polled angus, which last cross Mr. Goodnight believes gives promise of establishing a very superior grade of cattle.

Ovis mexicanus Merriam. Mexican Bighorn; Mountain Sheep.

Two 5-year-old rams and one 4-year-old from the southern end of the Guadalupe Mountains, Texas, and one 7-year-old ram from the mountains north of Van Horn agree in almost every detail of character with the type and topotypes of *Ovis mexicanus*[a] from Santa Maria, Chihuahua. They are older and a little larger than the type, and serve to accentuate some of the characters of the species.

Mountain sheep inhabit the Upper Sonoran and Transition zones of the desert ranges of extreme western Texas. They are found in the Guadalupe Mountains. A few have been killed in the Eagle and Corozones mountains and on the northwest side of the Chisos Mountains. They come into the Grand Canyon of the Rio Grande mainly from the Mexican side. Mr. R. T. Hill reports specimens killed in the Diablo Mountains, 25 miles north of Van Horn. The sheep are by no means confined to isolated mountain ranges. In several valleys I saw tracks where they had crossed from one range to another through open Lower Sonoran country. In this way they easily wander from range to range over a wide expanse of country in western Texas, and might be considered to have an almost or quite continuous distribution between the Guadalupe Mountains and the desert ranges of Chihuahua. Most of the ranges are steep, extremely rugged, and barren, with deep canyons and high cliffs. Here the sheep find ideal homes on the open slopes of terraced lime rock or jagged crests of old lava dikes, and, thanks to the arid and inaccessible nature of the country, they have held their own against the few hunters of the region. An old resident of one of the canyons, who has supplied his table with wild mutton for many years, considers them fully as numerous now as fifteen years ago. He has seen as many as 30 in a herd, but says they usually go in small bunches of 3 to 10, sometimes all rams and sometimes all ewes and lambs, but usually in mixed bunches. They come down the sides of the canyon in sight of the ranch, and are shot only when needed.

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[a] *Ovis mexicanus* Merriam, Proc. Biol. Soc. Wash., XIV, 29, Apr. 5, 1901.

While sweeping the slopes with the glass one evening near our camp in one of the big canyons opening into the Guadalupe Mountains, I located three sheep halfway up the face of the rocky slope, 1,000 feet above me. To the unaided eye they were invisible among the ledges and broken rocks, whose colors they matched to perfection, but through the glass they were conspicuous as they moved about feeding and climbing over the rocks. There were an old ram, a young ram, and a ewe. It was too near dark to make the long roundabout climb necessary to reach them, so I returned to camp and early the following morning started my camp man up the slope to the spot, while I went back up the canyon to get beyond them if they should run up the ridge. As I swept the slopes with the glass I heard a shot up where the sheep had been the evening before, and soon locating the hunter, watched him shoot two of them, while three others which were above climbed the cliff and finally disappeared over the crest of the canyon wall. The three that escaped were not much alarmed by the shooting. They jumped from rock to rock, pausing to look and listen, and turned back in one place to find a better way of retreat. They made some long leaps to reach the ledges above, but made no mistakes in their footing. Their motions were deliberate, and there was a moment's pause before each bound. I was amazed at the strength of the old ram, as, slowly lifting his massive horns, he flung himself with apparent ease to the rock above. The two lighter animals followed more nimbly, but with less show of power and without the splendid bearing of their leader, who often paused with head high in the air to watch the hunter below or to plan his way up the next cliff. While from below they seemed to be mounting the face of a steep cliff, I found later that it was not difficult to follow where they had gone.

It was interesting to note that these sheep had remained almost exactly where they were seen the night before. The two others may have joined them during the night, but more likely were all the time somewhere near, either lying down or hidden by the rocks.

The stomachs of the two sheep killed were full of freshly eaten and half-chewed vegetation, and most of the plants composing the contents were easily recognized by the stems, leaves, and fruit. The leaves, twigs, and carpels of *Cercocarpus parvifolius* formed a large part of the contents, while the leaves, twigs, and seed pods of Phila-

delphus microphyllus were present in less abundance. The seeds, stems, and leaves of the common wild onion of the mountain slopes were abundant and conspicuous in the mass, giving it a strong odor, while the black onion seeds, still unbroken and often in the capsules, were especially noticeable. A few bits of stems and leaves of grass were found in each of the stomachs, but they formed probably not over 2 per cent of the total mass.

Both of these sheep were in good condition, and the meat was tender, juicy, and delicious, with no strong or unpleasant taste. While it lacked the peculiar gamy flavor of venison, it came as near equaling it in quality as the meat of any game I know.

On August 22, in another range in which the bighorns were reported, I left the ranch accompanied by an old resident hunter. Riding hard up one gulch and down another we were soon 10 miles back in the mountains in a canyon with steep terraced walls rising from 1,000 to 2,000 feet above the open bottom. As we crossed the bottom a band of 12 or 15 mountain sheep bounded from the farther edge and started up the rocky slope in a long line of conspicuous bobbing white rumps led by three magnificent old rams. They had a quarter of a mile start, but in a very short time our hard-hoofed little horses had covered the stony gulch bottom and landed us at the base of the rocky slope within 250 yards of the sheep, which, having gained a point of sharp rocks above and feeling more secure, stopped to look down. As the king of the bunch suddenly paused on a sharp point and with a ponderous swing of his heavy horns turned to face us, my little 32–20 sounded weak and ineffective and only served to make him seek a higher ledge. But at the more spirited crack of the old ranchman's 30–30 the next in line, a buck with almost as heavy horns, rolled off the cliff with a broken neck and came sliding and tumbling to the base of the rocks a hundred feet below. The rest had scampered around the point of rocks, and as they came out again farther up and climbed cliff after cliff that from our base level seemed smooth and sheer a few more shots were wasted at long range. The herd divided and passed around both sides of the high peak. Following both trails for a mile or so to see if any of the sheep had been wounded, I found that I could go wherever they had gone. The cliffs were not so steep or so smooth as they had looked from below. In one place the animals had followed a narrow shelf above a sheer drop of 300 feet. Although they had jumped from point to point, striking their feet within an inch of the edge, I could not resist the impulse to lean close to the wall and keep my feet as far from the edge as the narrow shelf, which in places was not a foot wide, would allow. But some of the rocks crossed sloped at a steep angle, and the sheep had made daring jumps from rocky point to sloping surface, where their lives depended on [illegible] footedness. The farther I followed the more I admired [illegible] and nerve. I asked my companion if he had ever known [illegible] go where a man could not. He said he thought that they [illegible] sometimes make longer leaps down a sheer ledge than a man [illegible] go with safety, but that otherwise a man could go where [illegible]

[illegible] was interested in examining the feet of the old ram [illegible] and was struck first of all by the difference between [illegible] the hind feet, the front being fully twice as large as [illegible] square in form, with deeper, heavier cushioned heels, [illegible] less worn dewclaws. As the hind quarters of the [illegible] and fully two-thirds of the animal's weight comes [illegible] feet, this difference in size is not surprising. The [illegible] of the hind dewclaws is easily accounted for by their [illegible] holding back as the sheep goes down hill. While the [illegible] edges of the hoofs are of the hardest horn, the deep [illegible] heels are soft and elastic, veritable rubber heels, with a [illegible] covering over a copious mass of tough, elastic, almost [illegible] nerveless tissue. While fresh, before the specimen [illegible] cushioned heels may be indented slightly with the thumb, [illegible] how they would fit and cling to the smooth surface [illegible] rock where wholly hard hoofs like those of a horse would [illegible] you can turn your back to a steep slope of glacier [illegible] and walk up it on the palms of your hands [illegible] take one step with the roughest hobnailed shoes. [illegible] are too heavily cushioned beneath [illegible] fairly [illegible] more movable, boneless kind. [illegible] the fresh specimen were the [illegible] had developed [illegible] of an inch thick [illegible] with a sharp knife. [illegible] thus protected, and [illegible] the sheep had been [illegible] above a sharp [illegible] a bare surface of [illegible] of rough [illegible] they [illegible] that for [illegible] and the [illegible] of thorns [illegible] legs of the sheep [illegible] cactus and agave [illegible] off in spines [illegible] the base of the [illegible] these thorns were the terminal spikes from the leaf blades of *Aga* *lecheguilla*, which grows in great abundance over the hot slopes of t mountains, and which the horses avoid with even greater care th they do the numerous species of cactus.

The glandular disks under the eyes of this ram were more conspi ous than in any other specimen I have ever examined, probably account of his mature age, which his horns showed to be 6 or 7 yea The gland is an elevated rim of thickened, black, scantily haired sk with a depressed center, and measures about an inch across. stands out prominently on the surface, and appears from the fl side of the skin as well as from the front as a round thick pad. has an oily or waxy secretion and a rank, sheepy odor.

In color the old rams were decidedly darker than the ewes a younger members of the herd, but all blended with astonishing h mony into the browned, rusty, old, weathered limestone of their cho hillsides. Even the soiled white rump patches were just the color freshly broken faces on the rocks seen here and there over the slop As the band of sheep sprang away up the slope the white rump patcl were so conspicuous that I could not believe at first that the anim were not antelope; but higher up, as they stopped among the ro to face us, they could easily have been mistaken for a group of roc As they appeared again farther away on the ridge beyond the gul the bobbing, white rump patches were conspicuous signal marks long as the animals were running away from us, but when they turn their forms were completely lost in the background.

These sheep did not appear to run very fast, but probably few a mals save the panther can catch them in a race over the rocks. A f days later, while hunting panther in these same hills, it was demo strated that deerhounds can not catch nor tire out the sheep o their own trails, although my companion claimed that they were r very swift runners on open ground.

The meat of our 7-year-old ram was rather tough and dry, b without any bad flavor. The people at the ranch where I was st ing, who had eaten young sheep, considered the meat superior venison. Although shot at 4 p. m., our sheep had a full stomach a must have been feeding for an hour or two. His teeth were imp fect. One or two molars were missing in the lower jaw, and, a result, the contents of his stomach were rather coarse, and many the plants were easily recognized. Over half of the contents w composed of the green stems of *Ephedra trifurcata*, which I at fi mistook for grass, but which could not be mistaken on careful exa ination. The stems, leaves, and flowers of *Tecoma stans*, a beauti yellow-flowered bush, were conspicuous, as also were the leaves, sten and berries of *Garrya wrighti*. A few twigs with leaves and fru pods of *Pentstemon* were found, and a quantity of ripe fruit of *Opuntia engelmanni*, including the chewed-up pulp and seeds of at least half a dozen of the large pear-shaped berries. Some other leaves and stems were found that I could not recognize, but a careful search failed to reveal a trace of grass in the stomach. Part of these plants are Lower and part Upper Sonoran species, and the sheep seem to inhabit the two zones freely. The cold slopes and upper benches of the mountains are Upper Sonoran, however, and probably are to be considered the animals' real home. Transition zone does not occur in this range.

It is with some hesitation that I make public these facts as to the abundance, distribution, and habits of mountain sheep in western Texas, and only in the hope that a full knowledge of the conditions and the importance of protective measures may result in the salvation instead of extermination of the species. It would not be difficult for a single persistent hunter to kill every mountain sheep in western Texas if unrestrained. Not only should the animals be protected by law, but the law should be made effective by an appreciation on the part of residents of the country of the importance of preserving for all time these splendid animals.

Sciurus ludovicianus[a] Custis. Western Fox Squirrel; Louisiana Fox Squirrel.

In eastern Texas the fox squirrels are large and richly colored like those of Louisiana, and a small proportion of their numbers are melanistic. Of 7 specimens taken at Arthur one was almost black, and the hunter with me said that among 14 squirrels killed on a previous hunt 4 were black or very dark. Hollister saw a black squirrel at Antioch and reported many at Rockland. A few black individuals among many of the others were reported at Tarkington. To the west the animals grade without any abrupt change into the smaller, paler colored *limitis*. Specimens from Gainesville and Matagorda county, while intermediate, are in size and color nearer to *ludovicianus* than to typical *limitis*.

Fox squirrels are reported by Loring, Oberholser, and Hollister as more or less common at Texarkana, Waskom, Joaquin, Antioch, Long Lake, Troup, Milano, Brenham, Rockland, Conroe, Jasper, near Beaumont and Sour Lake; and I have found them at Tarkington, Liberty, Richmond, Cuero, Jefferson, Gainesville, and Arthur. Others reported from Elgin, Austin, Decatur, Brazos, and Wichita Falls are probably intermediate between *ludovicianus* and *limitis*.

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[a] If a type locality can be established for *Sciurus rufiventer* E. Geoffroy (Cat. Mus. Hist. Nat., 1803, p. 174) within the range of the form known since 1806 as *Sciurus ludovicianus* Custis, or if the type specimen sent to Geoffroy by Michaux from America can be identified as the Louisiana form, it will become necessary to revert to the name *rufiventer*. Meanwhile I prefer to use a long-established name in preference to one three years older, the application of which is still open to question.

At Arthur in northeastern Texas, and in the Big Thicket region of southeastern Texas, they inhabit the hickory and oak covered ridges, and leave the dense river bottoms and swamps entirely to the gray squirrels; but farther west in the more open country they inhabit both the timbered river bottoms and the oak ridges. They live mainly in hollow trees, but also make bulky nests of leaves and twigs out on the branches. When alarmed these squirrels run to the nearest hollow tree or up the first tree with branches leading to one, and are soon safely hidden inside, but if they do not reach some safe retreat they are so skillful at hiding that they often escape the hunter by keeping on the farther side of trunk and branch. Their food consists mainly of nuts and acorns, but fruit, berries, and lichens also are eaten. When feeding on nuts their flesh has a delicious *nutty flavor*.

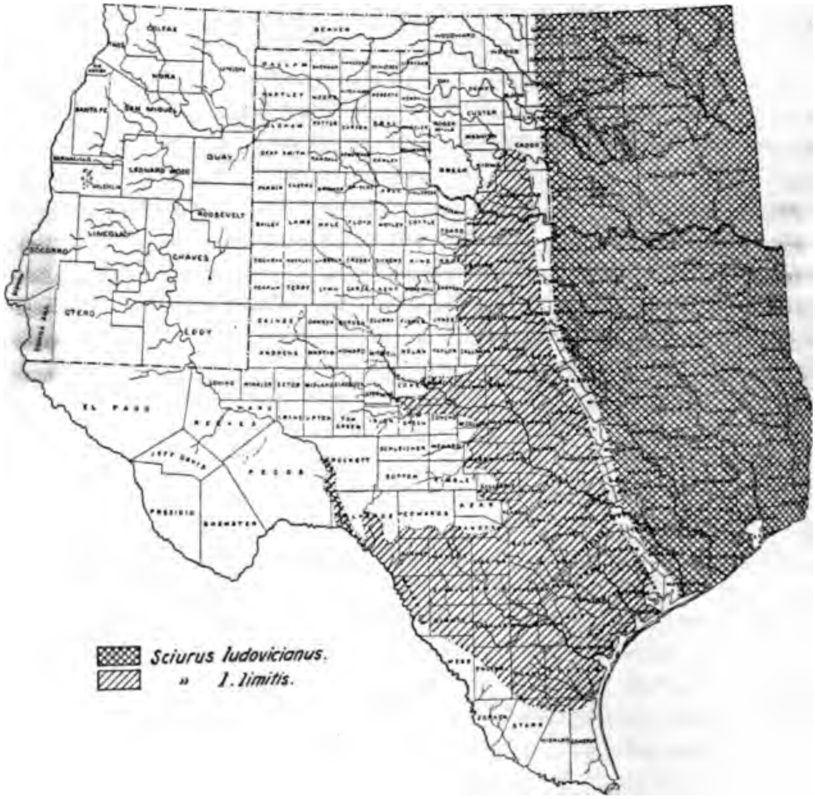

FIG. 10.—Distribution areas of fox squirrels (*Sciurus ludovicianus* and *S. l. limitis*).

Sciurus ludovicianus limitis Baird. Texas Fox Squirrel.

Sciurus texianus Allen, Bul. Am. Mus. Nat. Hist., XVI, p. 168, 1902. (Not of Bachman, 1838.)[a]

The Texas fox squirrel differs from the Louisiana animal in smaller size and paler coloration. So far as I can learn, it is never [illegible]. It inhabits the semiarid part of the Lower Sonoran zone, to the west reaching the canyon of the Pecos, the Rio Grande at the mouth of Devils River and at Del Rio, and farther south, extending across into Coahuila and Nuevo Leon, Mexico. To the east it grades into *ludovicianus*, but specimens from the mouth of the Nueces River, San Antonio, Seguin, Brownwood, and Henrietta are referable to *limitis*. There are specimens from Devils River, Del Rio, Rock Springs, Japonica, Ingram, Kerr County, San Antonio, San Antonio River in Victoria County, near the mouth of Nueces River, Cotulla, Mason, San Angelo, Brownwood, Henrietta, and Vernon; and Oberholser reports a few 12 miles north of San Diego and in the Pecos Valley near Fort Lancaster.

In this half-forested mesquite region the little fox squirrels inhabit the timber along the streams, where the pecan, hickory, oak, and [illegible] walnut trees furnish their favorite food and a few hollow trees afford protection, but nowhere within their range do they get the deep shade of the forests farther east. Wherever the pecan tree is found along the streams from Kerrville to the Rio Grande they are abundant. Specimens were collected on the Guadalupe at Ingram and Japonica, on the Hackberry near Rock Springs, and on Devils River. A few were seen on ridges between rivers, but they keep [illegible] to the bottoms. They are closely associated with the pecan [illegible] the branches or hollow trunks of which they [illegible] largely on its nuts, and rarely wandering away from [illegible] Devils River, where the [illegible] old trees [illegible] perfection and form [illegible] their spreading branches [illegible] the little fox squirrels [illegible] among the branches, [illegible] the gnarled old [illegible] worn smooth by ages of use as doorways. Usually, however, no protection is needed beyond their quick ear for detecting an approaching footstep, their natural skill at hiding on the farther side of a trunk or branch, and their rapid retreat among the branches from tree to tree.

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[a] [illegible] the name *texianus* [illegible] Allen [illegible] southwestern [illegible] with specimens [illegible] strictly to the larger [illegible] The measurements [illegible] indicate that Bachman [illegible] specimens of an apparently [illegible] was said to have been received [illegible]

Late in July we found the squirrels beginning to cut off many of the green pecan nuts, apparently just to test if they were nearly ripe. The last year's crop of nuts was probably exhausted, as the squirrels were feeding on various other things. Along the Guadalupe River, July 4 to 7, they were eating seeds of the cypress cones, and had their hands and lips covered with pitch, while the ground was strewn with half-eaten cones. It was then too early for them to begin barking much, but a few soft barks of warning were heard near our camp on Devils River late in July.

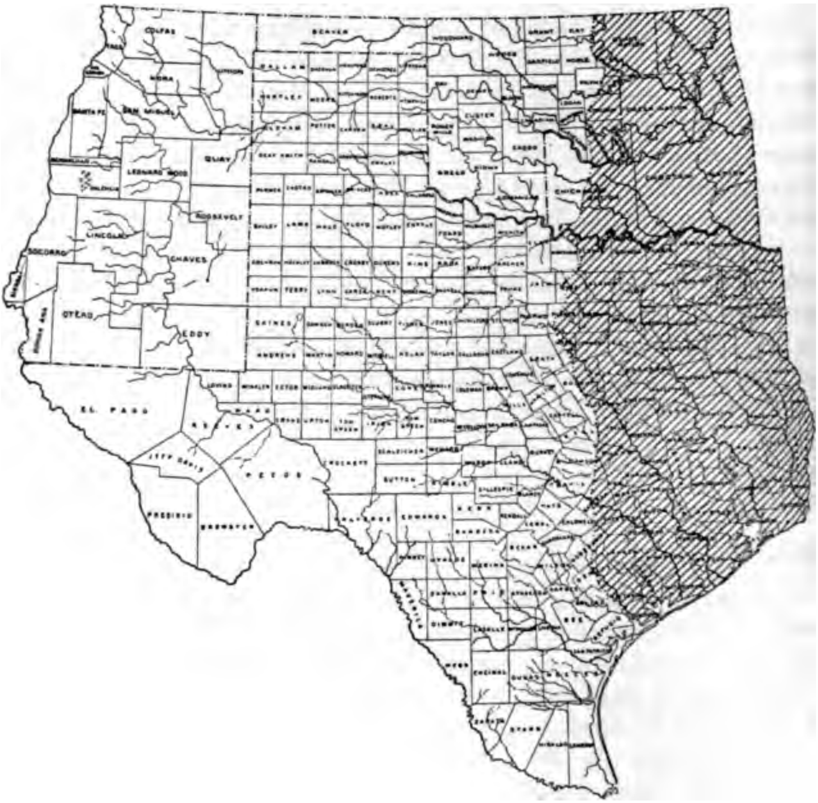

FIG. 11.—Distribution area of gray squirrel (*Sciurus carolinensis*).

Sciurus carolinensis Gmelin. Gray Squirrel.

Gray squirrels inhabit the timbered region of eastern Texas as far west as the mouth of the Colorado, Cuero, Austin, and Brazos [illegible] examined from the mouth of the Colorado, Sour Lake [illegible] Long Lake, Jasper, Troup, Arthur, and Joaquin are almost [illegible], which seems to have a continuous range from [illegible] coast west through Lower Sonoran zone to its extreme [illegible] central Texas. Gray squirrels are reported from [illegible] Jefferson, Waskom, Antioch, Long Lake, Jasper, Con[illegible] Livingston, Saratoga, near Beaumont, Brenham, [illegible] Rockdale [illegible], and except along the western edge of their [illegible] said to be common or abundant.

[illegible] to prefer the tall timber of the river bottoms and not to [illegible] to the lower and more open woods. At Arthur I [illegible] abundant on the flats of the Red River, but found none [illegible] ridges, where the fox squirrels were common. The two [illegible] seemed to keep entirely apart, and old hunters claim that [illegible] squirrels choose their ground and keep the fox squirrels [illegible]. In the Big Thicket of Hardin and Liberty counties, [illegible] and December of 1904, the grays were numerous [illegible] the heavy timber and dense swamps of the bottoms, while [illegible] fox squirrels were found in scattered groves along the edge [illegible] Livingston [illegible] Liberty prairies. Acorns and [illegible] furnish [illegible] of food and countless hollow trees [illegible] retreat. [illegible] numerous branch [illegible] Spanish [illegible] of the two. The perfect [illegible] the gray moss [illegible] from the hunter.

[illegible]a fremonti lychnuchus Stone & Rehn. [illegible]

[illegible] the Guadalupe Mountains [illegible] tree squirrel [illegible] of it, however [illegible] squirrel [illegible] Mountains, a little [illegible] may find their way [illegible] Texas line.

[illegible]pterus volans querceti Bangs. [illegible]

[illegible] from Texas [illegible] perfectly with [illegible] slightly [illegible] hind feet [illegible]

[illegible] squirrels are reported [illegible] Texas, where they [illegible] distribution through [illegible] records are from Elgin, where Oberholser reports [illegible] as tolerably common; and from Aledo and Benbrook (just west of Fort Worth), where Cary saw a stuffed specimen which came from that place, and was told of a family of 8 taken in 1901 from a hole in an elm a mile west of Aledo. They have been reported from Guadalupe River, Richmond, Brenham, Long Lake, Antioch, Rockland, Saratoga, Sour Lake, Conroe, Jasper, Waskom, Jefferson, and Texarkana.

Flying squirrels are among the most strictly nocturnal of mammals and are rarely noted except by timber cutters, who see them flying from their nests in falling trees. While every wood chopper in the east Texas region is familiar with them, it is difficult to get specimens. They are not easily trapped and often live in hollows in the large trees, where pounding with an ax does not start them from their nests. While hunting in the Big Thicket of Liberty and Hardin counties I often heard their fine, whistling squeak from the branches over my head at night, and occasionally the rustle of their feet on the bark of a tree close to the trail I was following.

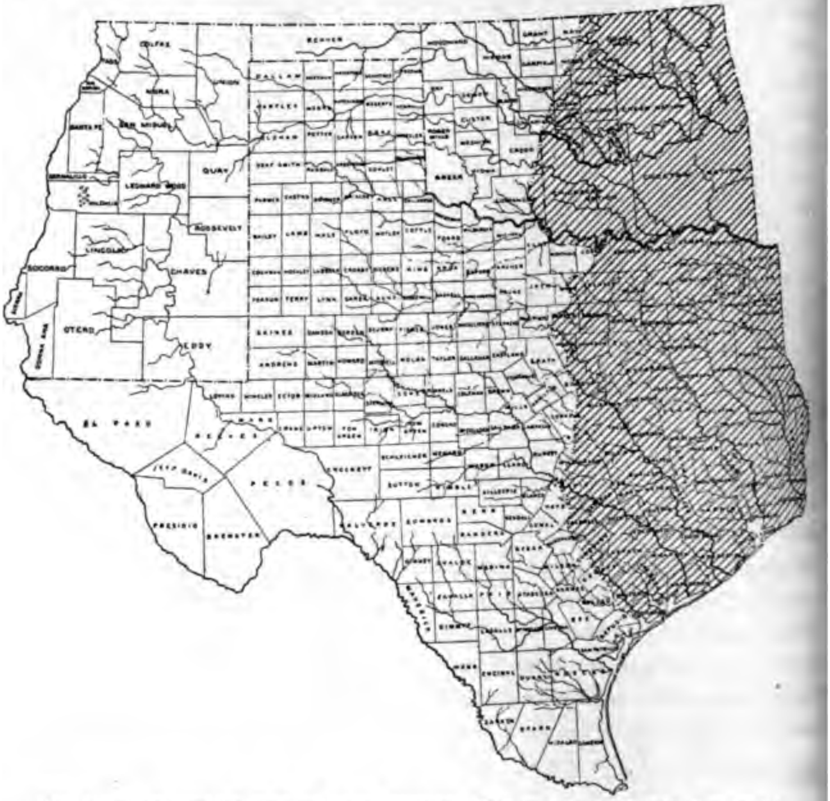

FIG. 12.—Distribution area of flying squirrel (*Sciuropterus volucella querceti*).

At Mike Griffin's place, 8 miles northeast of Sour Lake, Gaut was [illegible] dead pine out in the field where flying squirrels were said to [illegible] a deserted woodpecker's hole. By pounding on the base of the [illegible] flying squirrels were driven out and secured. A few days [illegible] were driven out of the same tree and secured, and [illegible] later two more, making in all six specimens from [illegible]

[illegible] cinereicollis canipes Bailey. Gray-footed Chipmunk.

Gray-footed chipmunks are common in Transition Zone [illegible] Guadalupe Mountains, from 7,000 feet in Dog Canyon [illegible] Canyon up to at least 8,500 feet and prob[illegible] top of the peaks at 9,500 feet, at which altitude they are [illegible] Sacramento Mountains a little farther north. While [illegible] in the lower part of the range, between the Guada[illegible] the Sacramentos, they seem to be identical in the two ranges [illegible] easily have a continuous distribution between. In the [illegible]ento Mountains they occupy the whole width of both the [illegible]tion and Canadian zones. In the Guadalupe Mountains they [illegible] from the lower edge of the Transition zone upward with the [illegible] pine and Douglas spruce, but in September they were com[illegible] associated with the shrubby oaks, several [illegible] start over the upper slopes of the [illegible] in the densest timber, [illegible] gathering the little sweet acorns [illegible] logs or rocks eating them [illegible] with acorn shells. Occasionally [illegible] lower branches of a tree, but [illegible] and disappeared among [illegible] the thick cover [illegible]

[illegible]

[illegible]spermophilus interpres M[illegible]

[illegible] antelope squirrel [illegible] north of [illegible] Mountains [illegible] Pecos [illegible] Guadalupe Mountains [illegible] of the species [illegible] region of [illegible] course of [illegible] tains. In fact the presence of canyons, bare cliffs, and rocks, with which the species is closely associated, seems to be the determining factor of its range within its zone.

Near El Paso and in the Great Bend of the Rio Grande, near Boquillas, these little squirrels live along the steep banks of the river or in the narrow side gulches that cut back into the barren mesas. Along the Pecos Canyon they are found on the rock shelves of the canyon walls; and around the Castle and Guadalupe mountains, and at Sierra Blanca they occur in rocky gulches or along low cliffs. They burrow under the edge of a bowlder or around the base of a bunch of bushes or cactus, and are usually seen either running from bush to bush, sitting on a point of rock, or running over the rocks with their short, bushy tails curled tight over their rumps. Sometimes they climb to the top of a cactus or low bush, apparently in search of food, but at the first alarm they rush for a burrow or the nearest rocks.

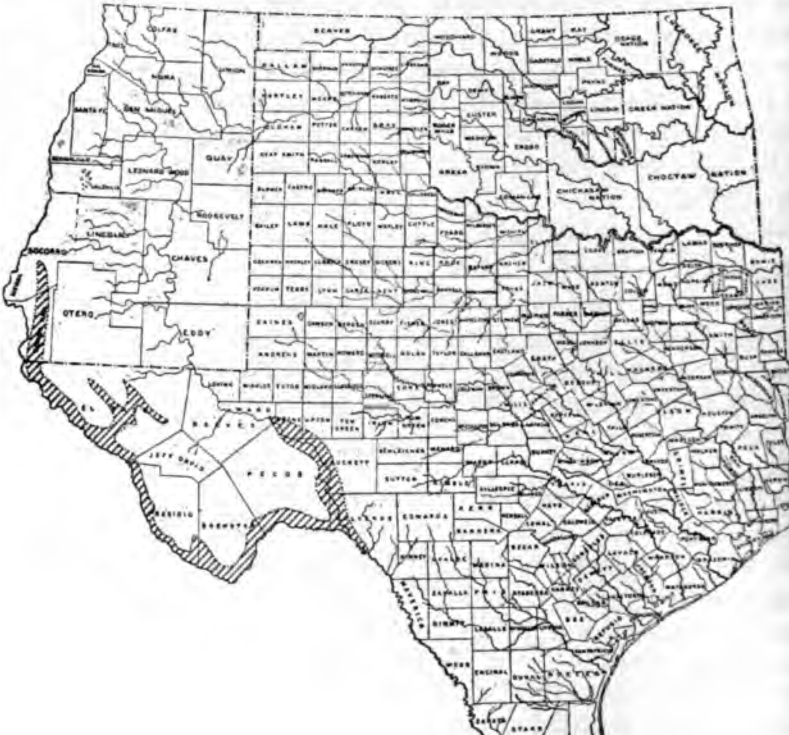

FIG. 13.—Distribution area of Texas antelope squirrel (*Ammospermophilus interpres*).

Near Boquillas in May the half-grown young were out with the others getting their own food from the various seeds and fruits, and [illegible] the acacia and mesquite bushes to secure the ripening bean [illegible], were found scattered in abundance about their burrows. [illegible] of one shot in September in the Castle Mountains by [illegible] full of the fruit of *Opuntia engelmanni*, which [illegible] the specimen, thinks must have been the squir[illegible] for some time, as its flesh was tinted throughout [illegible] of the fruit.

[illegible] little fellows become very fat and probably hiber[illegible] coldest weather. At El Paso in December, 1889, I [illegible] on warm days, although very lazy and sluggish, [illegible] feeding on various seeds, [illegible] those of the [illegible] I [illegible] the beautiful long silky winter fur, very [illegible] short, harsh summer coat. Along the east [illegible] of [illegible] Mountains, in February, 1903, Cary found them [illegible] drizzling rain when the temperature was close to [illegible]

[illegible]us variegatus couchi (Baird). Couch Rock Squirrel.

[illegible] often entirely black, rock [illegible] the Chisos and Davis [illegible] Rio Grande, Pecos, and D[illegible] phase from entire[illegible] crown, [illegible] back and gray [illegible] shoulders of [illegible] the Rio Grande [illegible] Baird's report [illegible] have been seen [illegible] company [illegible] Chisos [illegible] Zone [illegible] [illegible] tensively on the old juniper berries and acorns of the previous year, digging for them under the trees and in many places keeping the ground well stirred. By the middle of July they begin on the nearly matured acorns of one of the black oaks (*Quercus emoryi*) and also on the new crop of juniper berries (*Juniperus pachyphlœa*). Some of those shot were feeding largely on green foliage, the leaves of clover and various plants, and along the Rio Grande mainly on the juicy fruit of *Opuntia engelmanni.* None of those taken in summer were very fat, but in January, 1890, in the Davis Mountains, I found them excessively so. They were then keeping very quiet and came out of their rocky dens only on warm days.

Citellus variegatus buckleyi (Slack). Black-backed Rock Squirrel.

This, the handsomest of the rock squirrels, with glossy black head and shoulders, inhabits a restricted area in the rough and semiari mesquite country along the eastern slope of the southern arm of th Staked Plains, from Mason and Llano to a little west of Austin an San Antonio, and again west to Kerrville and the head of the Nuec River. Specimens examined from Mason, Llano, near Austin, nea Kerrville, Japonica, and Rock Springs (39 in all) do not vary t any great extent, except that in a few the black extends over th back to base of tail.

Along the upper branches of the Guadalupe and Nueces rivers the squirrels are common in rocky places. I saw them near Ingram an collected specimens near Japonica and on Hackberry Creek nea Rock Springs, while the ranchmen reported them as common in al rocky gulches throughout this strip of rough country. West of Roc Springs we did not find any trace of rock squirrels, there being n suitable country, until *couchi* was found in the lower part of Devil River Canyon. Apparently the open divide between the headwate of the Nueces and the headwaters of the streams flowing into th Rio Grande separates the ranges of *buckleyi* and *couchi* with a neutra strip in which neither occurs. Near Camp Verde, in Kerr County Cary found them common in the rocky cliffs, where he secured specimens, and was told by the ranchmen that the squirrels had a habi of appearing in considerable numbers on the cliff just before a storm. They did this with such regularity that the ranchmen depended on it as a sure sign of rain.

Mr. J. H. Tallichet, of Austin, sent a specimen from Bull Creek, Travis County, and wrote, under date of September 18, 1893:

> I send to you by this mail a specimen of the spermophile which occurs i this part of the State. * * * The specimen is an immature male which I killed while camping last year. His cheek pouches were filled with corn and melon seeds. These rock squirrels live in the débris at the foot of the canyon walls and are very wary. Full-grown specimens are nearly as large as tree squirrels and are eaten by the country people.

In habits *buckleyi* is a true rock squirrel, and is never seen at any great distance from cliffs or broken ledges. At Llano I found one pair near a cliff living in a hollow oak tree which they entered by holes in the branches 15 or 20 feet from the ground. They climbed the tree and disappeared—as quickly as any tree squirrel could have done—and did not show themselves at the openings for half an hour. Generally, however, the squirrels are found sitting on the rocks doing picket duty, ready at the slightest alarm to slide noiselessly over the edge of a rock into a burrow, under a bowlder, or into a break in the cliff. They are exceedingly shy and have to be stalked as carefully as an antelope. By the middle of May the half-grown young are out caring for themselves and feeding in the same manner as the adults.

Piles of acorn shells near the burrows indicate that acorns, when obtainable, are the principal food of the squirrels, which in summer, however, feed mainly on flowers, fruit, and green vegetation. The stomach of one examined contained mostly pulp of green cactus fruit (*Opuntia engelmanni*), together with parts of the big yellow cactus flower, while several of these flowers with the green berry attached were found on the rocks where the squirrels were in the habit of sitting. The stomach of another was filled with the white starchy pulp from the base of young leaves of *Yucca stricta*. Most of the yucca plants near the dens of the squirrels had part of their leaves cut out, and on examination I found the base of these leaves tender, sweet, and starchy, with a rather pleasant flavor. Another individual had the stems and leaves of a little stonecrop in its pouches. Flowers seemed to be a rather common food, and the contents of the stomachs often showed spots of red, yellow, and blue from the various species eaten. A squirrel shot on Hackberry Creek at the edge of a little corn field July 14 had its cheeks stuffed full of green corn, and the field showed many ragged ears.

Most of the squirrels collected in May were lean and muscular, but one that happened to be in good condition proved as good eating as any tree squirrel, while the young of the year were always tender and delicious.

Citellus variegatus grammurus (Say). Rock Squirrel.

The rock squirrels of the southern Guadalupe Mountains and the Franklin Mountains near El Paso, Tex., are typical *grammurus*, with ight gray head and shoulders. In the Guadalupe Mountains they are common, together with the junipers and oaks, from 4,000 to 7,000 feet throughout the Upper Sonoran zone. They usually live along he rocky canyons, but are sometimes seen in the open woods, where hey climb the trees for the sweet berries of *Juniperus pachyphlaea* nd the little acorns of the gray oak, or dig acorns of the previous ear from the ground under the trees. Down in the foothill canyons

we found them feeding on cactus fruit (*Opuntia eng*
Cereus stramineus) and walnuts (*Juglans rupestris*). O
shot in Dark Canyon had thirteen of these little walnut
of small cherries in its cheeks and a lot of cactus fruit in
They are shy and usually silent, but when danger thr
loud, vibrant whistle rings back and forth from the canyo

Citellus mexicanus parvidens (Mearns). Rio Grande Grou

The Rio Grande ground squirrels show no important
variation over a wide range in western Texas. Spec
Brownsville are a little larger than typical individuals
from Altuda are of minimum size. They inhabit appro
whole mesquite region or arid Lower Sonoran zone of
common at Brownsville, Rockport, Mason, Colorado, a
the Pecos Valley north to Roswell, and westward to the
and beyond. Wherever the scrubby mesquite tree grows
rows are sure to be found under its shade, or, if in the
enough to it for them to feed on the sweet pods, pieces o
often seen scattered around their holes. They are strict
squirrels,' and climb only into low bushes for seeds and
depend entirely on their burrows for protection. Like m
smaller ground squirrels of the arid regions, they usual
under the edge of a cactus or some low, thorny bush, w
obtain shade and the protection of thorny cover. They
do not hibernate, but during the cold weather have the uns
habit of closing their burrows and remaining inside. I h
them in these closed burrows at Del Rio in January and
on the 9th of May, when my traps were set, as I supposed,
gophers or moles. Also near Rock Springs in July I fo
burrows that I attributed to this species. The habit of
entrance of the burrow is unusual in the squirrel family
probably be accounted for as a protection against enemies,
cially snakes. Near Rock Springs I took a half-grown squ
a bull snake which had killed and just begun to swallow it

Like other members of the genus, these ground squirre
seeds, grain, fruit, green foliage, lizards, and numerous i
often gather around gardens and grain fields, where the
siderable damage in spring by digging up corn, melons,
various sprouting seeds, and, in summer and fall, by feed
ripening grain. Specimens examined at Roswell, N. Mex
were feeding on about equal proportions of seeds and insec

Citellus tridecemlineatus texensis (Merriam). Texas Groun

This southernmost form of the 13-striped ground squirr
a narrow strip of half prairie country through the midd

Texas, where the timber and plains intermingle—from Gainesville and Vernon on the north to Richmond and Port Lavaca on the south. Apparently its range is more or less broken and scattered, although the animal is common in places. A little colony was found at Richmond, and Oberholser saw a mounted specimen at Port Lavaca, said to have been killed near the town, where they were reported as occurring.[a]

In habits, voice, and general appearance they do not differ much from *tridecemlineatus*. They live in the open grassy prairies or around fields and depend on their burrows for shelter and their striped brown coats for protection. They feed largely on grasshoppers and other insects, together with seeds, grain, fruit, green herbage, and flowers.

Citellus tridecemlineatus pallidus (Allen). Pale Ground Squirrel.

The little, pale striped ground squirrel is common in Upper Sonoran zone over the top of the Staked Plains, where it is often seen running through the short grass or standing erect and stake-like at the edge of its burrow. A number of specimens collected in August at Washburn had been feeding mainly on grasshoppers, which were abundant over the plains. A few other insects were noted in the stomachs examined, and one of the spermophiles had been eating the fruit of the small prickly pear (*Opuntia macrorhiza?*), the seeds of which were stored away in his pouches.

Citellus spilosoma major (Merriam). Large Spotted Ground Squirrel.

The spotted spermophiles from Lipscomb, Canadian, Miami, Mobeetie, Colorado, Pecos City, and Monahans, Tex., and Carlsbad, Roswell, and Santa Rosa, N. Mex., agree in their large size and coarse, indistinct spotting with *major* from Albuquerque, N. Mex., but show slight variation with almost every change of soil and surroundings. The foregoing localities, which completely surround the Staked Plains, lie near the junction of Upper and Lower Sonoran zones, but as the species ranges north to Las Animas and Greeley, Colo., it apparently belongs to Upper Sonoran.

These quiet, shy, inconspicuous little ground squirrels live in burrows under the edge of clumps of bushes or on open, grassy plains. Their fine, trilling whistle is often heard from behind a bush or weed patch. I have found their stomachs full of grasshoppers and beetles and their pouches full of seeds of sand bur (*Cenchrus tribuloides*), and have seen little heaps of the empty bur shells scattered about their burrows. Usually they are not sufficiently numerous in agricultural regions to do serious damage in the grain fields.

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[a] Two specimens recorded by Doctor Allen from Bee County, Tex. (Bul. Am. Mus. Nat. Hist., III, p. 223, 1890), as *Spermophilus tridecemlineatus*, eight years before *texensis* was described, I assume to be referable to this form.

Citellus spilosoma marginatus (Bailey). Brown Ground Squirrel.

This little brown, sharply spotted ground squirrel is apparently an Upper Sonoran form, living on the dark lava soil of the Davis Mountain plateau. The type was caught in the open valley near Alpine, and others were seen on the mesa at Fort Davis and along the east base of the mountains. Specimens from Valentine, Presidio County, Van Horn, and Toyahvale are referred to the species, though not all are typical. The Toyahvale specimens show some of the characters of *major*.

In no part of their range have we found these spermophiles common, but like other members of the group they are inconspicuous, shy little fellows, rarely heard or seen. They burrow in the open or under the edge of a bush or cactus and usually keep close to their homes. They often live under the dense, spinescent bushes of *Microrhamnus*, which is common in this region.

Citellus spilosoma arens (Bailey). Spotted Sand Squirrel.

These little sand-colored ground squirrels are common in the open part of the valley bottom below the town of El Paso, where they make their burrows in the sand banks among scattered bushes of *Atriplex*, *Suaeda*, and mesquite, with little protection from the glaring light and scorching heat of summer. Their coloration is wonderfully protective, and being shy little animals and not very abundant they are rarely seen unless located by their fine bird-like whistle. They seem sensitive to a slight degree of cold and apparently hibernate early in winter, for I could find no trace of them in December about the same holes where I had caught them the previous July. Doctor Fisher found them common in May, but says that a windy day kept them in their burrows.

Citellus spilosoma annectens (Merriam). Padre Island Ground Squirrel.

A number of specimens, including the type of *annectens*, were taken by William Lloyd near the two ends of Padre Island, and others by H. P. Attwater on Mustang Island.[a] In August, 1891, Lloyd says they were abundant, but in November, when the island was again visited, only one was seen. Apparently they were keeping mainly in their burrows. He reported them also from the mouth of the Rio Grande and at Rio Grande City, but secured only one specimen on the mainland on the sandy beach at the mouth of the Rio Grande. He says that they seem to live in the crab burrows and are very shy, but their call note, similar to that of a grass finch, is occasionally heard.

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[a] Bul. Am. Mus. Nat. Hist., VI, p. 182, 1894.

Cynomys ludovicianus (Ord). Prairie Dog.

The prairie dogs inhabit an area comprising more than one-third of the State of Texas. Their range extends from Henrietta, Fort Belknap, Baird, and Mason west almost to the Rio Grande, north over the Staked Plains and the Pan Handle region, and south to the head draws of Devils River, to 10 miles south of Marathon and 25 miles south of Marfa. While to the northward inhabiting mainly Upper Sonoran zone, in Texas they extend well into the upper edge

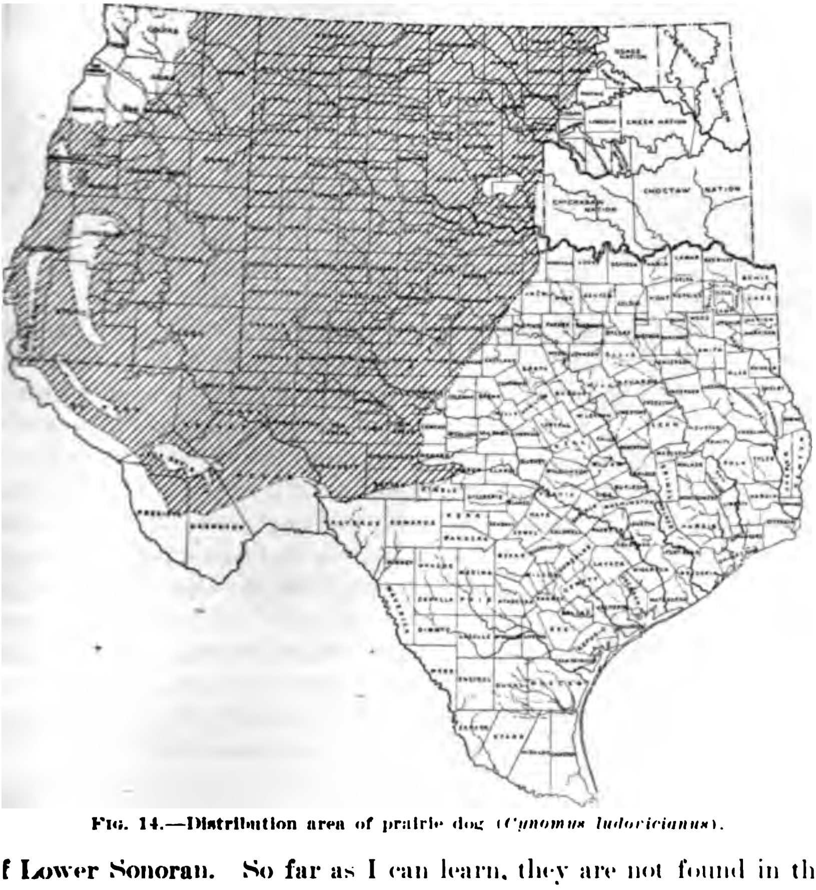

FIG. 14.—Distribution area of prairie dog (*Cynomys ludovicianus*).

f Lower Sonoran. So far as I can learn, they are not found in the nmediate valley of the Rio Grande or nearer to the river than ierra Blanca, except one little colony 2 miles east of Fort Bliss, nor o they occur elsewhere in the Lower Sonoran zone much beyond the cattered traces of Upper Sonoran species of plants. Normally they elong to Upper Sonoran zone, but their strong tendency to expanion carries them slightly beyond its bounds. In the Davis Mountains hey range up to 5,800 feet in an open valley on Limpia Creek at a point where the first yellow pines appear, while on the main ridge of the Guadalupe Mountains and in Dog Canyon, which is named for them, they straggle up to 6,900 feet, or to the very upper limit of the Upper Sonoran zone. Usually they are found in scattered colonies or 'dog towns,' varying in extent from a few acres to a few square miles, but over an extensive area lying just east of the Staked Plains they cover the whole country in an almost continuous and thickly inhabited dog town, extending from San Angelo north to Clarendon in a strip approximately 100 miles wide by 250 miles long. Adding to this area of about 25,000 square miles the other areas occupied by them, they cover approximately 90,000 square miles of the State, wholly within the grazing district. It has been roughly estimated that the 25,000 square mile colony contains 400,000,000 prairie dogs.[a] If the remaining 65,000 square miles of their scattered range in the State contains, as seems probable, an equal number, the State of Texas supports 800,000,000 prairie dogs. According to the formula for determining the relative amount of food consumed by animals of different sizes (Yearbook Department of Agriculture, 1901, p. 258), this number of prairie dogs would require as much grass as 3,125,000 cattle.

In many places the prairie dogs are increasing and spreading over new territory, but on most of the ranches they are kept down by the use of poison or bisulphid of carbon, or, better, by a combination of the two. As a Texas cattle ranch usually covers from 10,000 to 100,000 acres, the expense of destroying the prairie dogs in the most economical manner often means an outlay of several thousand dollars to begin with and a considerable sum each year to keep them down.[b]

The increase of prairie dogs is plainly due to the destruction of their natural enemies, badgers, coyotes, foxes, ferrets, hawks, eagles, owls, and snakes, many of which are destroyed wantonly.

The prairie dog is a plump, short-eared, short-legged, short-tailed little animal of the squirrel family, cleanly in habits, good-natured, and eminently social in disposition. If there are only a dozen in a big valley they will be located on an acre of ground where they can visit back and forth among the burrows, play or fight, and take turns in standing guard. If there are thousands of them their burrows will be found close together over the plain to the edge of the 'dog town,' beyond which none will be seen for perhaps 10 or 20 miles. On a trip from San Angelo north over the Staked Plains we were with them for weeks, both in the region of their continuous range and among scattered colonies. In places they were comparatively tame, and would sometimes let us drive within 20 feet, and even then they would not go entirely down their burrows. From a distance they could be seen watching us. A few were always sitting on top of their mounds barking an alarm, but on our nearer approach all scampered for the nearest burrows, while those farther ahead took up the alarm. When once half within the funnel-shaped entrance of the burrow the courage of the prairie dog revives, and with hands braced across the doorway, and with erect, flipping tail, the animal keeps up a steady barking at the intruder, sinking lower and lower, until finally with a quick dive, a shrill chatter, and a farewell twinkle of the tail, it vanishes down the hole. Frequently when you reach the burrow the animal can still be heard sputtering and chuckling deep down in the earth, and when once driven into its hole it does not soon reappear. It takes no little patience to await an hour or more the reappearance of the little black eye that cautiously peeps over the rim to see if the coast is clear.

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[a] Yearbook U. S. Department of Agriculture, 1901, p. 258.

[b] For methods of destroying prairie dogs see 'The Prairie Dog of the Great Plains,' by C. Hart Merriam (Yearbook U. S. Department of Agriculture, 1901, pp. 257–270), and 'Destroying Prairie Dogs and Pocket Gophers,' by D. E. Lantz (Bul. 116, Experiment Station, Kansas State Agricultural College, *Manhattan, Kans.*).

Promptly with the rising sun the prairie dogs come out for their breakfasts, at which time a 'dog town' is as animated as any metropolis, but with the setting sun they retire to their burrows. Breakfast lasts for a good share of the day, with intermissions for work and play and a good long midday nap. There are always burrows to be dug deeper or new ones to be started, rims to be built higher, and in damp weather the crater-like mounds to be molded. Immediately after a shower, often before the last drops have fallen, the prairie dogs are out scraping up damp earth on the rim around the burrow and pressing the funnel-shaped inside into proper form with their stubby noses. In this way an effectual dike, sometimes a foot or two in height, is formed around the entrance of the burrow. But during a cloud-burst I have stood in a dog town and seen all of the burrows with rims not over 6 inches high fill with water; and in the track of an unusually violent downpour have seen the bodies of dozens of drowned prairie dogs scattered along the gulches.

The food of the prairie dog is mainly grass. Not only are the leaves and stems eaten, but the roots are dug up until the circles of bare ground around the burrows become wider and wider. Many other plants, some seeds, and a few insects are eaten, but to a less extent than grass. After a long season of drought or a succession of dry years it often happens that every green thing is exterminated in a prairie-dog town and the animals are forced to move on to new pastures. In a dry season I have ridden over long stretches of barren and deserted dog towns; and, again, after a year of abundant rain, have found this same ground growing up to worthless weeds, or, if to grass, only to the equally worthless foxtail.

In autumn the prairie dogs become fat, but in Texas they do not regularly hibernate as they do to some extent in the North. If their fur should become fashionable, or roast prairie dog an epicurean dish, the problem of keeping them in check would be settled, and there is no reason, save their name, for not counting them, properly prepared and cooked, a delicacy. While owing their name to a chirping or 'barking' note of warning, they are in reality a big, plump, burrowing squirrel of irreproachable habits as regards food and cleanliness. An old stage driver expressed the idea in graphic words one day: "If them things was called by their right name there would not be one left in this country. They are just as good as squirrel and I don't believe they are any relation to dogs."

Mus musculus Linn. House Mouse.

Common house mice are found practically over all the settled part of Texas, even at most of the isolated ranches at a distance from railroads and towns. They were caught at deserted adobe cabins in the Great Bend of the Rio Grande, 100 miles south of the Southern Pacific Railroad. They are by no means confined to houses and outbuildings, but over much of the country have become established in the fields, meadows, hedgerows, and weed patches, from which they collect in the stacks of hay and grain, and are ready to attack each crop as it matures.

Mus norvegicus Erxl. Wharf Rat.[a] Brown Rat.

Wharf rats are common in most of the towns of Texas and on some of the ranches, but they are not so generally distributed in thinly settled regions as the house mouse, nor do they take so readily to the fields and country. In the years 1889 and 1890 there were reports of swarms of rats overrunning parts of the State, but the species are uncertain, nor is it known whether the wharf rat was one of them. At Seguin, Guadalupe County, in November, 1904, I found wharf rats in great abundance around farm buildings and along fences and weedy borders of fields, wherever sufficient cover was offered. Their runways and burrows resembled those of the cotton rats, but were larger and did not extend so far out from cover. Along the edge of a cornfield numerous cobs were scattered under the fence, where the corn had been eaten off. In Mr. Neel's tomato patch the ripe tomatoes were being rapidly devoured, and I caught a rat in the midst of the patch by using a ripe tomato for bait.

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[a] *Mus rattus* Linn. Black Rat. A black rat collected by Lloyd at Brownsville proves to be a melanistic *Mus norvegicus*, closely resembling *M. rattus* in color. I find no specimens or records of the latter species from Texas, but as it is found farther east and west it undoubtedly will be taken in the State.

Mus alexandrinus Geoffroy. Roof Rat.

Two specimens of the roof rat, caught in July, 1902, on the Guadalupe River at Ingram, Kerr County, constitute, so far as I can learn, the [illegible] record of the species for the State. It seemed strange to [illegible] mammal, which is usually found near the coast, [illegible] interior of a thinly settled country, but the explana- [illegible] The Guadalupe River is subject to violent floods, [illegible] suddenly to 50 feet above low water. The enormous [illegible] rubbish deposited along the bottoms and in the [illegible] have evidently furnished a highway for the dis- [illegible] rats from the coast up the river. The two individ- [illegible] living in these drift heaps and were caught in [illegible] *attwateri*. One was caught on the ground at the [illegible] heap; the other on a pole reaching across from one heap [illegible] A specimen reported by H. P. Attwater in 1894 was [illegible] boat that made trips between St. Charles Peninsula and [illegible] and was said to have been on the boat about a year.[a]

Onychomys longipes Merriam. Texas Grasshopper Mouse.

[illegible] dull colored form of the grasshopper mouse occupies [illegible] Lower Sonoran zone of southern Texas, and, so far as [illegible] reaches its eastern limit at Rockport, [illegible] Angelo, and its western limit at Comstock [illegible] south of Brownsville [illegible] Mexico. [illegible] brushy, half open [illegible] from the region [illegible] Red River on the east [illegible] fact that this strip [illegible] most species of [illegible] and specimens [illegible] It [illegible] strictly nocturnal [illegible] far from our camp [illegible]

Onychomys leucogaster pallescens [illegible]

[illegible] most of its range [illegible] found in the [illegible] Transition [illegible] Plains [illegible] Valley at [illegible] Specimens [illegible] one specimen [illegible] to *pallescens* [illegible] However [illegible] locality [illegible] with a good growth of sagebrush (*Artemisia filifolia*). They make few holes, though two were taken at the mouths of small burrows. A turtle ate the head of one specimen and a rattlesnake tried to swallow another, but was prevented by the trap.

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[a] Bul. [illegible]

Throughout a wide range these little animals live on the short-grass plains or in the sagebrush country, and are caught at all sorts of burrows, an old badger, prairie-dog, or spermophile hole being a favorite resort, probably on account of the insects to be found within. They are strictly nocturnal, and while never seen by daylight, their long-drawn, fine whistle is often heard in the grass between dusk and early dawn. The morning round of a line of traps usually reveals one or more specimens that have been attracted by the oatmeal bait, and just as often shows some half-eaten *Perognathus*, *Peromyscus*, kangaroo rat, or other small rodent that happened to be in the trap when this forager came along. The *Onychomys* stomachs usually contain, besides finely chewed seeds and grain, an interesting assortment of grasshoppers, crickets, beetles, scorpions, and small insects, and occasionally parts of a lizard or mouse.

Onychomys torridus (Coues). Arizona Grasshopper Mouse.

Onychomys torridus arenicola Mearns. Proc. U. S. Nat. Mus., XIX, Advance Sheet, May 25, 1896, p. 3. Type from El Paso.[a]

These little long-tailed grasshopper mice occupy the arid Lower Sonoran zone of western Texas from El Paso to near the mouth of the Pecos, and up the Pecos Valley to old Fort Lancaster and Monahans, and Carlsbad, N. Mex. They are found on the open, barren mesas among stones and cactus and the characteristic desert vegetation, or in the sandy mesquite bottoms of the Rio Grande and Pecos rivers. Like all the genus they are strictly nocturnal, and while prowling about at night get into traps set at the burrows of various other mammals. About all that we know of their habits is gained from examination of their stomachs, which usually contain, besides a small portion of seeds or grain, a larger share of scorpions, grasshoppers, crickets, beetles, and various other insects.

Peromyscus leucopus (Rafinesque). White-footed Mouse.

The dark-colored *Peromyscus* from the coast region of southeastern Texas, while not quite typical *leucopus*, seems to be nearer to it than to *mearnsi*. There are specimens from near Alvin, near Galveston, Velasco, Elliott, Arcadia, Matagorda, Deming Station, and east Carancahua Creek. To the west apparently it grades into

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[a] Specimens in the Biological Survey collection from El Paso, Sierra Blanca, Marfa, and Alpine do not differ so far as I can see from the type of *torridus* and from specimens taken around the type locality, when corresponding pelages are compared. It is a little, dark, richly colored species, becoming pale in late winter and spring. Neither in the dimensions nor in the skulls can I find any character by which to recognize the subspecies *arenicola*.

[illegible] immature specimens from Gainesville, Decatur, and [illegible] suggest intergradation with the same form.

[illegible] these mice at Deming Bridge, Matagorda County, [illegible] where a quantity of brush had been cut down to fill [illegible]." Near Matagorda he says "they live in trees, [illegible] moss and in hollows in the roots." At Velasco [illegible] "edge of creek" and another from "edge of old [illegible] Bayou, near Alvin, he collected an old female [illegible] grown embryos, March 17, 1892. Beyond these [illegible] Lloyd nothing is known of the habits of the [illegible] region, where apparently it inhabits the timbered [illegible] with the palmetto and Spanish moss.

[illegible] leucopus texanus (Woodhouse). Texas White-footed M[illegible].

[illegible] Mearns, Proc. U. S. Nat. Mus. Vol. XVIII, Advance [illegible] May 25, 1896, p. 3. Type from Rio Grande 6 miles above [illegible]

[illegible] species over the arid Lower Sonoran Zone of [illegible] from El Paso to Del Rio, Rock Springs, and Fort [illegible] south it grades into [illegible]. Specimens from [illegible] Rock Springs, and San Antonio are not typical of either [illegible] enough of the characters of both to [illegible] intermediate. A series of 33 specimens from [illegible], 2 from Miami [illegible] from Mobeetie [illegible] Panhandle, [illegible] from Hemphill [illegible] can be referred to [illegible] these mice take [illegible] group [illegible] of the group [illegible] and [illegible] they are often [illegible] Lipscomb [illegible] traps [illegible] found the [illegible] Lipscomb. However, [illegible] the creek bottoms." At Canadian he caught one "in the grass along an irrigation ditch" and another "in a deserted cabin." At Miami he caught two "in the rocky bluffs near town and one on the sandy bottoms," and at Mobeetie others "along the sandy creek bottoms in traps set for *Perognathus* and *Perodipus*."

Like other members of the genus, they are strictly nocturnal, and during the day keep safely within their burrows in the ground or in some other dark retreat. As a result they are almost never seen alive, except when they get their tails instead of their necks in our traps. Very little is known of the habits of this species.

Peromyscus leucopus mearnsi (Allen). Mearns White-footed Mouse.

Peromyscus canus Mearns. Proc. U. S. Nat. Mus., Vol. XVIII, Advance Sheet, March 25, 1896, p. 3. Type from Fort Clark, Tex.

The Mearns white-footed mouse ranges over southern Texas from Brownsville north to Eagle Pass, Fort Clark, and San Antonio, and east to Rockport, grading into *leucopus* on the east and *texanus* along its northern boundary. There is certainly not room for an intermediate form between *texanus* and *mearnsi*, which *canus* proves to be.

The region inhabited by *mearnsi* is semiarid chaparral and cactus plains in Lower Sonoran zone. At Brownsville, the type locality of the species, Lloyd collected a large series of specimens and reported the species as "very common out to the sand belt." He also caught a few on Padre Island and around Nueces Bay. Another series was collected at Brownsville by Loring, who says of the mice: "Quite common. Found in the willows along the river bank and under logs and brush near the overflows. Several were caught in traps baited with meat." At Hidalgo, Loring says: "They were taken in traps baited with oatmeal and set by hedge fences, cactus beds, and underbrush." In writing of specimens obtained at San Lorenzo Creek and Santa Tomas, Lloyd says: "They prefer an arid region where grass is scant among the cactus." At Corpus Christi the mice were very scarce, and I caught but one in a long line of traps. It was at a hole in the bank just back of the beach. At Beeville Oberholser reports them as "evidently not very common, as all my trapping failed to reveal more than a single individual." At San Diego he says: "This animal does not appear to be more than tolerably common. It lives only in the damp thickets bordering the ponds and water holes in the chaparral: at least my trapping in all kinds of situations failed to reveal its presence anywhere else."

Peromyscus michiganensis pallescens Allen. Little Pale Peromyscus.

This pale little mouse is represented in the collection by 9 specimens collected at San Antonio and one from near Alice. The one from Alice was collected by Lloyd 12 miles southwest of the town on open prairie. San Antonio specimens were caught by H. P. Attwater in traps set for harvest mice around brush piles.[a]

Peromyscus sonoriensis (Le Conte). Sonoran Peromyscus.

A few specimens of this little *Peromyscus* from Washburn, Tex., seem to be nearer to typical *sonoriensis* than to any of the subspecies in the group. One specimen was caught at a tiny burrow on the short-grass plains, miles from any cover that would conceal even a mouse, and others were caught on the prairie at the edges of fields.

Peromyscus sonoriensis blandus (Osgood). Frosted Peromyscus.

This pale, silky-haired little mouse is common in western Texas over the rough and arid region between the Pecos and Rio Grande valleys. There are specimens from the Franklin Mountains (15 miles north of El Paso), Sierra Blanca, Valentine, Onion Creek (Presidio County), and Bone Spring (53 miles south of Marathon). All the above localities are in rough country near the junction of Upper and Lower Sonoran zones, where more or less mixture of the two occurs, so that the zonal range of the species is not perfectly determined by them.

Although in a rough country, broadly speaking, these white-footed mice inhabit the smooth spots in the bottoms of open valleys. At Sierra Blanca they were on the broad flats southeast of the station, where the principal vegetation was low, scattered, composite shrubs (*Gutierrezia microcephala?* and *Crassina grandiflora*), among which they burrowed in the mellow soil, and the seeds of which furnished in winter a large share of their food. So far as their own genus was concerned, they held this ground by themselves, the larger *P. texanus* being caught in an old woodrat's nest under a yucca and the long-tailed *P. eremicus* in the nearest cliff of tilted rocks. At Onion Creek they were found living in holes in the soft, level ground of the creek valley, where none of the other species of *Peromyscus* were taken. At Valentine, out in the middle of a big open valley, I caught one of these little fellows under the doorstep of the house where I boarded, on the edge of town, and near Bone Spring, 50 miles south of Marathon, I caught another under a mesquite out in the open valley.

Peromyscus gossypinus (Le Conte). Pine Woods Peromyscus.

Specimens of this large, dark-colored *Peromyscus* from Texarkana, Jefferson, Long Lake, Joaquin, Jasper, and Sour Lake, indicate an extensive range for the species over the timbered region of eastern Texas.

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[a] Bul. Am. Mus. Nat. Hist., VIII., p. 64, 1896.

Apparently it is not an abundant species anywhere in this region, and much trapping is necessary to procure a few specimens. At Jefferson Hollister caught two in the woods near Big Cypress Creek, and at Joaquin one under a log on heavily timbered creek bottoms. Oberholser caught one in a canebrake along the Red River at Texarkana, one in heavy woods on the edge of McCracken Lake, near Long Lake, in Anderson County, and several in a cabin and one along a stream in the woods north of Jasper. In the heart of the Big Thicket, 7 miles northeast of Sour Lake, I caught several in and around old tumbledown buildings, and Gaut caught them around old logs and stumps in the woods.

Peromyscus boylei rowleyi (Allen). Rowley Peromyscus.

Peromyscus boylii penicillatus Mearns. Proc. U. S. Nat. Mus., Vol. XIX, Advance Sheet, May 25, 1896, p. 2. Type from El Paso.

A large series of this big, long-tailed *Peromyscus* from the Franklin and Organ mountains is typical *rowleyi*, as apparently are also six other specimens taken in Dog and McKittrick canyons in the Guadalupe Mountains. In this region and farther north they range throughout Upper Sonoran zone, being closely associated with junipers and nut pines, as well as with rocks and cliffs. In places they follow the cliffs slightly below the junipers, but only where canyo walls offer especially favorable haunts. In the Guadalupe Moun tains they range to the upper limits of junipers, where the yello pines begin on dry, hot slopes at 7,800 feet, and down in the north east gulches near Carlsbad at the east base of the mountain slope 3,100 feet. While usually found along cliffs or among rocks, the are often common among junipers, nut pines, and oaks at considerab distance from any rocks. In such places they live in hollow trees logs or take advantage of any convenient cover. I have occasionall found them curled up in a soft nest in a hollow tree, and have ofte found a nest that I attributed to this species in a knothole or und a loose layer of bark. At one of our camps on top of the Guadalup Mountains, in a beautiful orchard-like park of junipers, one to possession of the camp wagon and made its nest among boxes an sacks.

The food of these mice consists largely of juniper berries, or least the seeds of juniper berries, of which there is usually an abundant supply at all times of the year, but acorns and pine nuts eaten while they last. The empty shells of seeds and nuts and acor show the favorite feeding grounds to be under the hollow base or lo spreading branches of a juniper.

[illegible]myscus boylei laceyi[1] subsp. nov. Lacey Peromyscus.

[illegible] Creek, Kerr County, Tex. Adult male, No. 92746, U. S. National Museum, Biological Survey Coll. Collected by H. P. Attwater, [illegible] No. 1372, X Catalogue.

[illegible] Size and proportions about as in *rowleyi*, to [illegible] nearly related. Color decidedly darker; under surface [illegible] more grayish.

[illegible] winter pelage dull, dark ochraceous, brightening [illegible] and upper surface of long hairy tail blackish; lower [illegible] dusky gray; belly and feet pure white. Summer [illegible] the rufescent phase; paler in the gray phase; [illegible] less grayish.

[illegible] pterygoid fossa generally narrower than in either [illegible]

[illegible] Type not measured in the flesh, but the hind foot [illegible] when dry. Average of four topotypes: Total length, [illegible] 97; hind foot, 23.2.

[illegible] Total length, 28; basioccipital length, [illegible]; nasal [illegible] breadth, 14; width of braincase, 13; mastoid breadth, [illegible] of upper molar series, 4.

[illegible] species of the group [illegible] long-tailed P[illegible]
[illegible] Upper Sonoran, rocky [illegible] covered [illegible] Kerr
[illegible] the Davis Mountains [illegible]
[illegible] from Turtle Creek [illegible]
[illegible] Mountains, Paisano, and [illegible]
[illegible] may all be [illegible]
[illegible] from Ozona and one from [illegible]
[illegible] pale. From *attwateri* [illegible]
[illegible] ated. *Lac*[illegible]
[illegible] color, black [illegible]
[illegible] good cranial [illegible]
[illegible] ranch, near Kerr[illegible]
[illegible] *attwateri*, without [illegible]
[illegible] of the two species. At [illegible]
[illegible] also they occur [illegible]
[illegible] They are large [illegible]
[illegible] part of the D[illegible] M[illegible]
[illegible] that we [illegible]
[illegible] timbered [illegible]
[illegible] Cary caught [illegible]
[illegible] Lloyd caught th[illegible]

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[1] [illegible] for Mr. Howard L[illegible]

Chinati Mountains, 35 miles south of Marfa. At Ozona and Big Springs they were taken in cliffs in the comparatively open country.

Peromyscus attwateri Allen. Attwater Peromyscus.

The Attwater peromyscus inhabits the cliffs around the edges of the lower arm of the Staked Plains from Big Springs, Llano, Austin, and Kerrville, west to Comstock and Langtry, and up the Pecos Valley to Fort Lancaster and Sheffield, the cliff and canyon country along the Rio Grande, and at least the lower slopes of the Davis and Chisos mountains, and extends westward into Mexico. Most of these localities are so near the edge of Upper and Lower Sonoran zones that the species might belong to either, except that among the cliffs and canyons it probably gets the cooler temperature of the higher zone.

At Howard Lacey's ranch, near Kerrville, where the type of the species was collected in 1895 by H. P. Attwater, I found these animals abundant in 1899, and caught them in crevices along the cliffs, under logs in the woods, and under fallen grass and weeds on the creek bank in the bottom of the gulch. At Ingram, also near Kerrville, Cary and I caught them in the rocks along the bluffs and under the heaps of flood drift on the river bottoms. At Camp Verde Cary caught a few under rocks and logs. One was taken on the crest of a juniper ridge near Rock Springs; Gordon Donald took one in the cliffs near Devils River Station, and N. Hollister caught a series in a little canyon near Comstock and one in the cliffs of the Rio Grande Canyon 8 miles south of Comstock. Lloyd caught one at the Painted Caves and Gaut collected 12 specimens in the canyons around Langtry. Oberholser caught 5 among the rocks at Fort Lancaster. Cary and Hollister found them in the cliffs along the Pecos Canyon as far up as Sheffield, and Cary took one individual of this species, together with *laceyi*, in a canyon at the east base of the Davis Mountains. In the Chisos Mountains a few were taken in Upper Sonoran zone from 6,000 to 7,000 feet. A small series taken among the rocks at Llano is typical *attwateri*, but a series of 13 specimens collected in the cliffs near Austin, where Oberholser reported them as the commonest small mammal of the locality, is not typical.

Peromyscus eremicus (Baird). Desert Peromyscus.

Peromyscus eremicus arenarius Mearns. Proc. U. S. Nat. Mus., XIX, Advance Sheet, May 25, 1896, p. 2. Type from El Paso, Tex.

This wide-ranging desert species inhabits the arid Lower Sonoran zone of western Texas from the Pecos Valley to El Paso. Specimens from Comstock and vicinity and from Carlsbad (Eddy), N. Mex., mark the eastern limit of its known range. There are specimens in [illegible] Biological Survey collection also from El Paso, Franklin Mountains, Sierra Blanca, Presidio County, Boquillas, Terlingua, 20 miles [illegible] of Marathon, Langtry, Painted Caves, and 65 miles northwest [illegible] slight variation in specimens from Texas localities [illegible] separation from typical *eremicus* of Fort Yuma. [illegible]

[illegible] this species is common in the cliffs just back of town, and [illegible] two were caught in a cliff near the station. At [illegible] Presidio County, 30 miles south of Marfa, it was [illegible]ds, and a few were taken in cliffs at Terlingua. [illegible] south of Marathon, at Comstock, and along the [illegible] Rio Grande at Langtry and Painted Caves. At Carlsbad, N. M., [illegible] occupied a limestone cliff near the river with [illegible] belongs to the zone above, and in this same cliff I [illegible] *leucopus* and [illegible], belonging, respectively, [illegible] Upper Sonoran zones. Of the habits of the desert [illegible] is known save what our traps reveal of its choice [illegible] the dusty rock shelves of cliffs and caverns, where lines [illegible] lead to and from cracks and small openings [illegible] the [illegible] never known of its being found away from rocks [illegible] habitat may have some connection with the [illegible] food.

Peromyscus taylori Thomas. Taylor [illegible]

[illegible] of these tiny, short-tailed [illegible] from [illegible] San Antonio do not [illegible] to be typical [illegible] San Diego, the type locality [illegible] Loring reported [illegible] in meado[illegible] Lloyd found the[illegible] very small [illegible] at the edge of [illegible] H. P. Attwater [illegible] 15 miles [illegible] interesting [illegible]

[illegible] of the ground [illegible]

down into the ground below the nest. In one of these holes a number of pecan nuts were found. The nest contained an old female and three half-grown young.

Peromyscus taylori subater subsp. nov. Dusky Baiomys.

Type from Bernard Creek near Columbia, Brazoria County, Tex. No. $\frac{32616}{44539}$ ♀ ad., U. S. Nat. Mus., Biological Survey Coll. Collected by Wm. Lloyd Feb. 25, 1892. Original No. 1122.

Characters.—Size and proportions of *P. taylori*, but much darker colored. Upper parts blackish or sooty gray, belly buffy.

Measurements of type.—Total length, 91; tail, 37; hind foot, 15. Average of 7 topotypes: Total length, 95; tail, 39; hind foot, 14.8.

Skull of type.—Basal length, 14.8; nasals, 6.3; zygomatic breadth, 10; mastoid breadth, 8.4; alveolar length of upper molar series, 3.

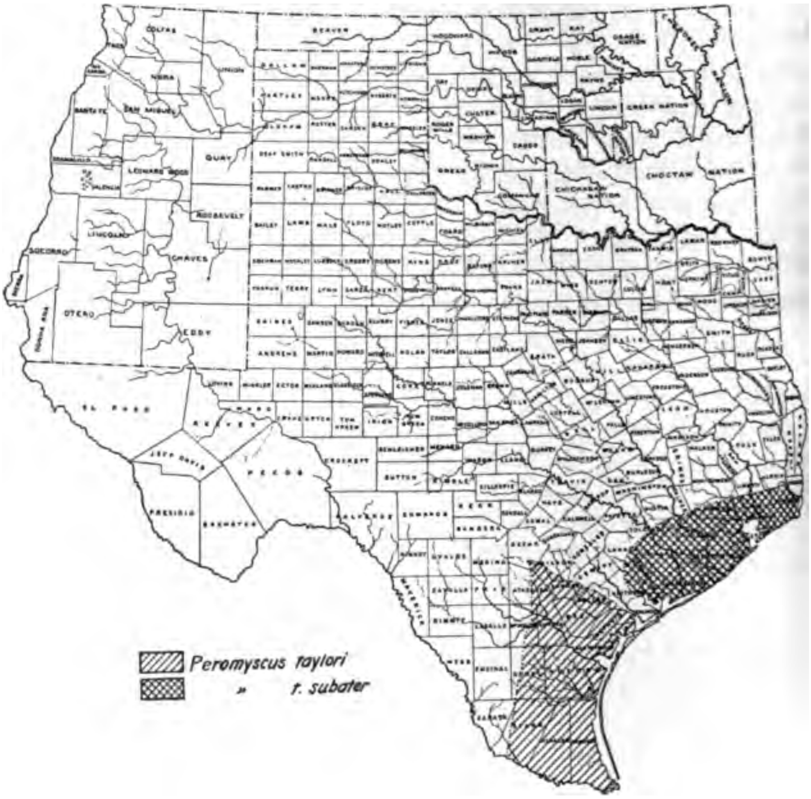

FIG. 15.—Distribution areas of the two forms of the subgenus *Baiomys* (*Peromyscus taylori* and *subater*).

This dusky form of the little *Baiomys* inhabits the coast prairies of Texas east of Matagorda Bay. Specimens from Matagorda, Matagorda Peninsula, Bernard Creek (12 miles west of Columbia), Richmond.

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[a] Allen, Mammals of Bexar County, Tex. Bul. Am. Mus. Nat. Hist., VIII, p. 66, 1896.

[illegible] Point, Alvin, and Sour Lake are referred to it, although the [illegible]gorda specimens are a little grayer and evidently tend toward

[illegible] Virginia Point on the mainland opposite Galveston, I caught [illegible] mice in a grassy orchard at a ranch on the broad [illegible] I [illegible] trapped in the grass-covered runways of sig[illegible] [illegible] these mice were fairly common under the rich [illegible] grass on the open prairie. Their tiny runways, leading [illegible] burrow to another, wound about over the surface of [illegible] among the plant stems and indicated habits so similar to [illegible] that at first I thought I had discovered traces of a [illegible] species of that genus. At Sour Lake Hollister collected [illegible] "on the open prairie." On Matagorda Peninsula [illegible] these mice living under logs near the Gulf shore where [illegible] both old and young. One young, about two weeks old, [illegible] a nest under a log February 11. In another nest two [illegible] found, and an old female taken the same day contained [illegible] developed embryos. On the mainland near Matagorda [illegible] got them in the long grass skirting the edges of fields." [illegible] containing three young was plowed up in the field Feb[illegible]

[illegible]ys palustris (Harlan). Rice Rat

[illegible] Allen, Bul[illegible] [illegible]
[illegible] Type from Rockport [illegible]

[illegible] rats inhabit the coast marshes [illegible] Christi, and a little reef near [illegible] Point [illegible] area they have not been found [illegible] County, some 10 miles up the [illegible] in the salt [illegible] They are common in [illegible] apparently confined to [illegible] but still out of [illegible] was flooded during [illegible] and not plain, the [illegible] On Matagorda [illegible] in the tufts of [illegible] rank grass [illegible] are common out in the [illegible] water readily. [illegible] traps. On a [illegible] end of Padre Island they were found in patches of marsh 'cranberry.' Two of their round cup-shaped nests, composed of fine rootlets, were found under old boards." At Virginia Point, opposite Galveston, I caught them in runways under the grass and rushes along the edge of the salt marsh. At that time, in April, they were rather scarce, but the people say that occasionally they become very numerous, especially in and around the rice fields.

Oryzomys aquaticus Allen. Rio Grande Rice Rat.

This species is known only from the vicinity of Brownsville, near the mouth of the Rio Grande.

Loring reported it as common in grassy spots in the mesquite brush.

Reithrodontomys intermedius Allen. Rio Grande Harvest Mouse.

> *Reithrodontomys laceyi* [a] Allen, Bul. Am. Mus. Nat. Hist., VIII, p. 235, Nov. 21, 1896. Type from Watson's ranch, 15 miles south of San Antonio, Tex.

This long-tailed harvest mouse inhabits the Lower Sonoran zone of southern Texas from Brownsville to Corpus Christi, San Antonio, Kerr County, and Del Rio, and extends south into Mexico.

At Brownsville Loring reported that he caught several specimens of this species in traps baited with meat and set among small willows, weeds, and high grass near the river. At Del Rio I caught them at little burrows on the brushy flats, and near Kerrville found them common around fields and in weedy places generally and caught them at burrows and runways under the fallen grass. Lloyd reported one found on Padre Island in an old cow's horn, and two dead ones in an old barrel. Between Laredo and Rio Grande City he reported two as living in old nests of the cactus wren, and near Corpus Christi he found one in a nest in a catsclaw bush. In April, 1900, I found what looked like an old verdin's nest in a bush of *Momesia pallida* near Corpus Christi. The nest was about 4 feet from the ground, a globular structure of grass, lichen, and short gray moss (*Tillandsia recurvata*), with a small opening at one side. As I touched the side, two black eyes appeared at the doorway, but after watching me for a moment were withdrawn. At a slight shake of the ish, out popped a trim little long-tailed harvest mouse, which sat ndecided on the branch for a moment and then ran gracefully along anches and stems from one bush to another and finally down to e ground, where it disappeared in the tall grass. On examining e nest I found a firm base, evidently an old bird's nest that had een arched over with a substantial roof which left an opening at the de only large enough for my finger. It was neither a verdin's or a cactus wren's nest, and evidently had been built or remodeled y the present tenant. When I returned the next day, the mouse was t home, but so sleepy that I merely disturbed him enough to make im come out and sit for a moment on the branch, after which I ithdrew and let him go back to finish his nap. Further search evealed two more similar but old and unoccupied nests in the ushes near by, but no trace of runway, burrow, or other signs of e mice on the damp sticky soil beneath. A good line of traps set mong the bushes and under the adjoining prairie grass remained ntouched until the bait grew moldy. Even at the base of the bush nder the occupied nest nothing was caught in several days' trapping, nd after a trip of two weeks I returned to find the little fellow still ccupying his nest.

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[a] Specimens of *Reithrodontomys laceyi* from San Antonio and Kerr County agree perfectly with specimens of comparable age and pelage from Brownsville, Matamoras, and Santa Tomas, and I see no way but to consider them typical *intermedius*. The slightly smaller and grayer specimens are evidently young of the year. The difference in size indicated by Mr. Attwater's measurements does not appear in comparison of skulls or hind feet and may be due to a slight difference in the methods of measurement. My own measurements of Kerrville specimens and Goldman's of his Matamoras specimens agree almost to a millimeter. While all of the small series of topotypes of *laceyi* can be matched from the large series of *intermedius* from Brownsville, there are none in as bright summer pelage as some specimens in the Brownsville series.

Along the Medina River 15 miles south of San Antonio, Mr. H. P. ttwater says he occasionally came across these mice in 1889 and 1890 hile hunting for birds' nests. He says they were found singly in the aytime in little round nests made of grass and placed in the lower ranches of small trees.[a]

eithrodontomys aurantius Allen. Louisiana Harvest Mouse.

This largest and richest colored of the Texas harvest mice inhabits astern Texas, and extends along the coast region as far west as latagorda Bay, and in the interior north to Hempstead, Nacogdohes, Joaquin, and Texarkana. There is every reason to suppose that inhabits the whole of eastern humid Texas, as usually it is not an bundant or easily captured species and is often overlooked by ollectors. At Texarkana Oberholser caught one and reported the pecies as rare about thickets on the edge of cleared ground. Holister caught several at Joaquin on grassy ground along the railroad nd at the edge of a cotton field, and at Sour Lake a few in tall grass t the edge of the woods. At Hempstead Gaut caught them in rushy woods between cultivated fields. In southern Louisiana I ound them in runways among weeds and tall grass on low ground t Iowa Station, and caught one in a trap where an *Oryzomys* was aught the preceding night. In Matagorda County, Lloyd reported them under old logs and in low brush, where numerous nests were seen with holes leading into the ground beside them. He called this species the "tree mouse," but does not speak of any nests in bushes or anywhere except on the ground. At Hempstead, Gaut caught a few in traps set at the bases of trees in a brier thicket between two cultivated fields, and in the Big Thicket, northeast of Sour Lake. he reports it as the most abundant mouse, living under the dead grass wherever there was dry ground.

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[a] Mammals of Bexar County, Tex., J. A. Allen, Bul. Am. Mus. Nat. Hist., VIII, pp. 66–67, 1896. For further interesting notes on habits of this harvest mouse in Bexar County by H. P. Attwater, see also page 236, same volume.

Reithrodontomys megalotis (Baird). Big-eared Harvest Mouse.

This pale, desert harvest mouse comes into western Texas between the Rio Grande and the Pecos, as shown by specimens from Fort Stockton, Pecos City, Alpine, and the southern parts of the Guadalupe and the Franklin mountains.

Cary secured a single specimen on the grassy plain 25 miles west of Fort Stockton, and another under matted grass near a flowing well at Pecos City, but was unable to catch any more in either locality. Gaut caught one in a patch of high grass about two miles north of Alpine, and another on a grassy flat in the foothills of the Franklin Mountains, 15 miles north of El Paso, at 4,400 feet. One was caught in a *Microtus* runway at 8,400 feet altitude on top of the ridge at the head of Dog Canyon in the Guadalupe Mountains. It was among grass, shin oak, and other low brush, and in a most unexpected locality for a *Reithrodontomys*. No other specimens were secured, although considerable trapping was done in the vicinity.

Reithrodontomys merriami Allen. Merriam Harvest Mouse.

This little dusky harvest mouse, the smallest species in the State, inhabits the coast prairies of southeastern Texas west to Richmond, but apparently is nowhere common. Near Richmond I caught two under the grass on the open prairie in the same runways where *Peromyscus taylori subater* was caught. Both of these specimens while in the traps were eaten by some other mouse, so that only the skull of one and the ragged skin of the other could be saved. At Austin Bayou, Lloyd caught the species in "rank grass on the prairie," and at Lafayette, La., R. J. Thompson caught one in "tall meadow grass on the prairie."

Reithrodontomys griseus sp. nov. Little Gray Harvest Mouse.

Type from San Antonio, Tex., No. 87852, ♂ ad., U. S. Nat. Mus., Biological Survey Coll. Collected March 4, 1897, by H. P. Attwater. Collector's number 1068 (X Catalogue No. 371).

General characters.—Size small, tail short and sharply bicolor; color buffy gray with indistinct dorsal streak of dusky; brain case short and wide.

Color.—Upper parts dark buffy gray, darkened especially along the [illegible] with black tipped hairs; ear with a large black spot on [illegible] surface and another on lower inner; feet and whole lower [illegible] white with a narrow blackish line above.

[illegible] Compared with that of *merriami*, the geo[illegible] nearest neighbor in the group, the skull is larger with [illegible] shorter, wider brain case, and flattened instead of [illegible] smaller bullae, and wider basioccipital. [illegible] differs as from *merriami* in relatively shorter, wider [illegible]

[illegible] Type: Total length, 120; tail vertebrae, 56; hind [illegible] (dry). Average of six adult males from type [illegible] by H. P. Attwater: Total length, 114; tail verte[illegible] 14.6.

[illegible] Occipitonasal length, 19.2; basal length, 16; nasals, [illegible] breadth, 10.4; mastoid breadth, 9; greatest breadth of [illegible] interorbital constriction, 3.

[illegible] Specimens examined from San Antonio, Mason, San [illegible] and Gainesville, Tex., indicate a rather unusual distri[illegible] eastern edge of the plains. At San Angelo, Ober[illegible] a hole in the grassy margin of a cultivated field; [illegible] caught one in a patch of [illegible] in the corner of a [illegible]. Another specimen was taken at [illegible] all of these localities [illegible] to be extre[illegible]

The present species hold[illegible] over an extensive area [illegible] San Antonio [illegible] Nebraska, where, if it [illegible] entirely between [illegible] the complete [illegible] San Antonio.

[illegible] floridana rubida Bang[illegible]

[illegible] wood rat [illegible] typical *habitat* [illegible]

[illegible] Texas [illegible]

[illegible] near [illegible]

[illegible] Bragg and Saratoga [illegible]

[illegible] the thick[illegible]

Dr. Griffin's place [illegible]

one secured was in a house of its own building at the base of an old dead pine. It had piled up pine bark and pieces of rotten wood around the base of the tree to a height of 2 feet, and in the cavities in this mound had made several soft nests of grass and bark fiber. There was a nest also in an old hollow log close by and several holes under a rotten stump not far away. As I tore the house to pieces in search of its builder a gray squirrel ran out of the first nest of grass and bark near the top and rushed up the old dead pine. As I uncovered deeper chambers one was found well filled with white-oak acorns and berries of the cat brier, and a cache of green leaves was safely stored away under a shelf of pine bark. The rat was found in a chamber deeper down near the bottom of the house. When finally uncovered it ran to the hollow log near by, then to the holes under the stump, then back to the house before I got a shot at it. It proved to be an old female, as were two others caught the next night under an old log in an equally dense part of the thicket. No trace of the rats was found except under the protecting cover of dense timber, brush, or vine tangle, or in hollow logs, trees, or old buildings. An old log house where hay was stored was apparently well stocked with them, judging from the stick piles under the floor, tracks in the ashes of the old fireplace, piles of characteristic pellets in the corners, and a familiar wood-rat odor pervading the air. More or less evidence of their presence was noticed in other old buildings.

In the thicket near Saratoga the Flower boys told me that a wild cat (*Lynx*) killed a short time before had been opened and its stomach found to be full of wood rats. The abundance of wild cats and barred owls throughout the Big Thicket probably accounts for the habit of the wood rats of choosing the most impenetrable cover.

At Houma, La., near the type locality of the species, I found these wood rats common in the woods and swamps. Some of the houses were built at the bases of hollow trees, over old logs, or under thick brush mats, but just as commonly they were placed in the lowest branches of trees or in vines 10 to 30 feet from the ground. Those in the branches were usually in a fork or on a large limb close to the body of a tree, or in a thick tangle of branchlets and connected with the ground by numerous vines, while those suspended in the vines were globular stick masses from 1 to 4 feet in diameter, worked in among a lot of ascending vine stems or into a snarl of vine branches and resembling magpies' nests. Slender sticks, twigs, and pieces of bark and gray moss formed the main body of these elevated houses, while a hole at one side afforded entrance to the soft nest of bark fiber and moss within. By shaking and jerking the vines I drove the rat out of one of these houses and watched him climb up the vines and branches to near the top of the medium-sized [illegible] feet from the ground. He climbed readily, but [illegible] freedom and speed, and avoided the trunk of [illegible] that I shook out of a house at the base of a small [illegible] to the top of the tree, some 20 feet from the [illegible] I [illegible] never seen one climb the trunk of a large tree, [illegible] they could climb a rough barked trunk. Several [illegible] on the ground were examined and in each was [illegible] nest of fine bark or moss in a chamber near the [illegible] could be found entering the ground below the [illegible] to the dampness of the soil, which may also [illegible] houses in this region. Some stick piles and [illegible] hollow logs, and on the ground inside the shell [illegible] sycamore stub, that measured 10½ feet across, the [illegible] good-sized house against the wall. Several holes [illegible] of this house, and superficial examination located [illegible] back corner. Well marked trails sometimes were [illegible] through grass and weeds from one house to another or [illegible] the nearest log, tree, or brush heap.

Neotoma floridana baileyi Merriam. Nebraska Wood Rat.

[illegible] form of the *floridana* group of wood rat [illegible] Texas. Two specimens in the Merriam [illegible] Cook County, are [illegible] referred to it, [illegible] color and in the [illegible] As a larger series [illegible] Wichita Mountains, O[illegible] necessary to refer the [illegible]

[illegible] large, pale [illegible] Wood [illegible] few of the [illegible] Wichita M[illegible] base to the [illegible] ground of [illegible] caves, [illegible] Cave, Stone County, M[illegible] of the great [illegible] houses more common under the shelving limestone ledges along the sides of the ravines. Three or four of those collected were cooked at the ranch where I was staying, and we all pronounced them better than gray squirrels. The meat was very tender and of good flavor, with no trace of the external musky odor peculiar to wood rats.

Neotoma floridana attwateri Mearns. Attwater Wood Rat.

On the juniper ridges of the southern arm of the Staked Plains this big buffy-brown wood rat, which appears to be an Upper Sonoran form of the *floridana* group, lives in a rocky, half-forested region. It makes its house sometimes among the rocks, piling up its rubbish in a broken cliff, rock pile, or old stone wall, and sometimes in the woods at the base of a tree, under a brush pile, in some old cabin, or along the river in heaps of flood drift.

In company with Mr. Howard Lacey, on his ranch in Kerr County, I uncovered one of the houses in the corner of an old log cabin where the rats had built up a pile of rubbish among the fallen logs and boards. As the material was removed the rat ran out of the nest into a hollow log, where he was easily caught. The nest on the ground under the rubbish pile was a bulky mass of soft juniper bark, with an opening at the side. Above it the spaces between logs and boards were filled with several bushels of rubbish, including a large number of cactus thorns. A quantity of green leaves of walnut and some pieces of green cactus stems were found near the nest, while scattered acorn and walnut shells, juniper berries, and cactus capsules showed part of the menu of the occupant.

Mr. H. P. Attwater, who first collected this species, tore down numbers of the houses and found nests in underground burrows as well as in the rubbish piles. He says:

> In one of the underground passages at the nest on the oak ridge were found stored away about three dozen bunches of wild grapes; also many acorns and black haws. In another nest in the cedar brake were about two dozen small mushrooms, partly dry and shriveled. All the heaps in the cedar brakes contained large stores of cedar berries, most of them with the outside pulp eaten off and the seeds eaten out. When the very small size of the seed is taken into consideration, it is surprising what an immense amount of work is necessary before enough can be obtained for a meal, as probably a thousand would be required. One nest contained shells of nuts of the Mexican buckeye (*Ungnadia speciosa*), although these nuts are reputed to be poisonous.[a]

Near Ingram, in the valley of the Guadalupe River, a few of these wood rats were caught in the cliffs and rocks bordering the river valley, but they were more common under the great heaps of driftwood and rubbish along the river bottoms. The Guadalupe, like many of the Texas rivers, is subject to floods, and in a sudden rise of *sometimes* 50 feet great quantities of driftwood are washed into the bottoms and left wherever the trees are close enough to hold it. In places among the old cypress trees tons of this driftwood lie in heaps like haystacks, and in and under these the wood rats find ideal homes. They make holes and runways through the heaps, and hollow out cavities for their nests inside. Often instead of making runways they traverse the logs from one heap to another. A favorite place for a nest is in the drift lodged in vines and branches of trees and reached by means of the vines or rough bark. The presence of the rats in these drift piles is easily detected by their peculiar musky odor. In spite of the odor, which apparently comes from the large gland along the skin of the belly, the flesh of the animals is delicious, of good flavor, white, tender, and more delicate than that of the squirrel.

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[a] Bul. Am. Mus. Nat. Hist., 1896, pp. 61–62.

Neotoma micropus Baird. Baird Wood Rat.[a]

This large, light slaty-gray *Neotoma* inhabits the arid mesquite country of the western half of Texas and the adjoining parts of Mexico, and extends north up the Pecos Valley in New Mexico to at least Santa Rosa, and from central Texas northward across western Oklahoma. Specimens examined from Rockport, San Antonio, Brazos, Seymour, Henrietta, Mobeetie, and Lipscomb mark approximately the eastern limit of the species in the State, as at present known. Judging by the characteristic houses which I found abundant near Wichita Falls, the species ranges east to the western edge of the Upper Cross Timbers, while a few old houses at Tascosa and Logan indicate a continuous range with the low mesquite up the Canadian River and across to Santa Rosa on the Pecos, thus completely encircling the Staked Plains. It is the most abundant and widely distributed of the Texas wood rats. It lives mainly in the half open country and builds houses under mesquites, acacias, zizyphus, allthorn, yuccas, cactus, or anything else sufficiently thorny to prove an effectual protection against its enemies. Rarely it lives among rocks. The favorite building site, however, is in and around a bunch of the big flat blades of the prickly pear (*Opuntia engelmanni*), where the stack of rubbish—cow chips, sticks, bark, leaves, stones, bones, pieces of metal, dishes, leather, rags, or any other available material, well salted with bits of cactus and other thorny things—is often built into a dome 4 or 5 feet high. An allthorn bush is another choice building site, and when the house is largely composed of its rigid angular thorns, well mixed with cactus, a more bristling and formidable combination can hardly be im of the houses, wherever located, are so well protecte that they are rarely molested by the larger mammals the tough-hided badger. But how the rats can r houses and along the trails strewn with cactus spines a a scratch on the bare, pink and white soles of their fee One or more nests placed in cavities of the house or beneath, and entered by openings through the sides edges of the mass of rubbish, are well protected not onl enemies, but from occasional violent storms and the g the sun. Usually these nests are slight structures grass, always kept neat and clean when in use, and q scattered remains of food and excrement. Well-wo under the brush from one house to another, or aw grounds, or to neighboring rock piles, for the rats se social disposition, several usually living together a doing much visiting.

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[a] The name of black wood rat applied to this species by Professor Baird is as much of a misnomer as its specific name *micropus*. As the species is one of the palest of the genus, I have thought best to change its name to Baird wood rat. The name 'rat' leads many people to associate with the wharf rats filthy animals introduced from the Old World and naturalized around our stables and cellars—the *wood rats*, which belong to a different genus, are natives of America, and animals of exemplary and extremely interesting habits.

Their food consists of a great variety of green ve cially the juicy flesh of cactus, but mainly of seeds, n Cactus fruit and the sweet pods of the mesquite bean a eaten; also acorns, nuts, and any kind of grain within t

At times the wood rats become exceedingly numer houses appear in every nook and corner of brush, thick patch, while the animals crowd into fields and about ra and do some mischief even in a thinly settled stock at such times they attract great numbers of hawks, o enemies, and after a year or two of unusual abundance to, and sometimes below, their normal numbers. I *Parabuteo u. harrisi* come out from under the mesquit this species in its claws, and have found the skulls of of the rats in and around the nest of this hawk, as well and fur in the crop of the bird. The skulls are among t bones recognized in pellets under the cliffs where the owls roost. Being both diurnal and nocturnal, these ject to the attacks of both hawks and owls. Coyot wild cats catch them whenever opportunity offers, a when they are numerous enough to be frequently enc from their houses. Snakes are apparently still more d as they enter the holes and houses of the rats and swa pants. Rattlesnakes, bullsnakes, blacksnakes, and w often found in and around the rat houses, and at Co opened a rattlesnake and found a wood rat in its sto ordinary conditions these wood rats are of little econom and will never prove to be a serious pest unless as a destruction of their natural enemies.

Cary found this species abundant at Monahans, and says:

> They usually have their nests in mesquite or zizyphus thickets, but frequently ake up their abode in the abandoned burrows of *Dipodomys spectabilis*, where horny branches in the mouth of the burrow give notice of their presence. Their stores usually consist of mesquite beans. They proved a veritable nuisance by continually getting into our small traps and running off with them. They took a number also of our traps home. So commonly was this done that on missing a trap Donald and I would go to the nearest rat house, where we were almost certain to find it. The people at Monahans, and in fact throughout the region, call them chicken rats on account of their supposed fondness for young chickens.

Neotoma albigula Hartley. White-throated Wood Rat.

This wood rat extends into Texas from the west, reaching its eastern limit along the eastern edge of the Staked Plains at Llano, near

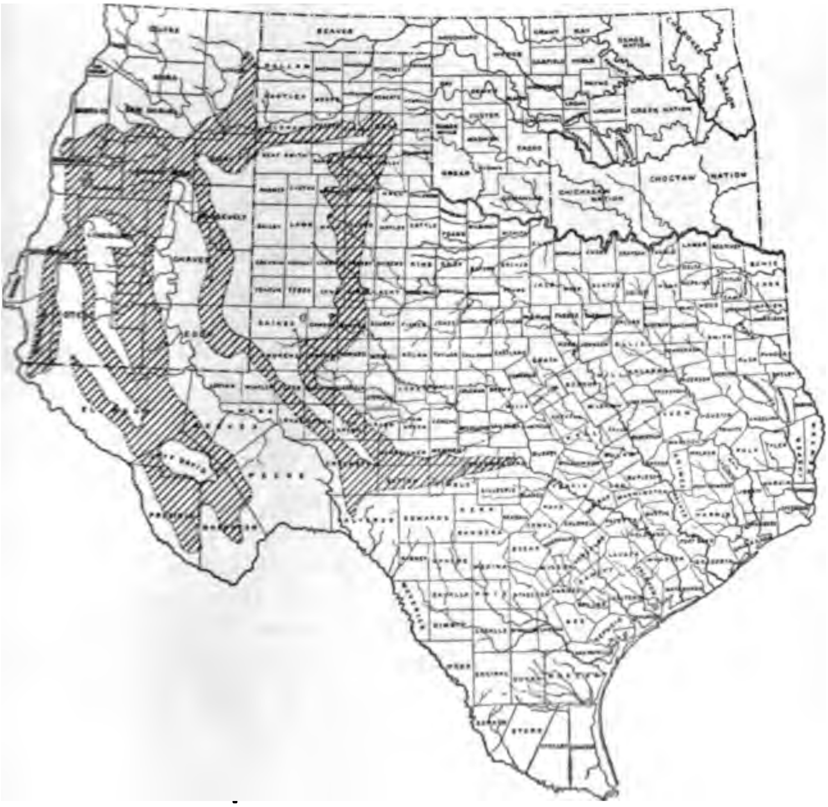

FIG. 16.—Distribution area of white-throated wood rat (*Neotoma albigula*).

Colorado, and in a canyon near Washburn. It apparently belongs to Upper Sonoran zone, but along cliffs and rocky gulches extends into the upper edge of Lower Sonoran, and so slightly overlaps the range of the larger and grayer *micropus*. Both species occur side by side at El Paso, Sierra Blanca, Kent, Stanton, and Colorado, and in Presidio County, Tex., and at Carlsbad, N. Mex., but each retains its distinctive characters and habits, *micropus* living mainly in its stick houses in the brush, and *albigula* always keeping among the rocks along cliffs and gulches. In a few cases I have caught *micropus* in the rocks, but have never found *albigula* away from them. Being a cliff dweller, its houses are largely provided by nature, and a few sticks, chips, and stones piled among the rocks in addition are often all that seems to be required, but sometimes these accumulations of rubbish in a favorite and long-inhabited den amount to 20 or 30 bushels. The doorways are usually plainly indicated by scattered remains of food and various unmistakable signs. A strong musky odor characteristic of the genus is the usual indication that the dens are inhabited.

I have never known this species to become very abundant or very troublesome. It sometimes enters houses and barns located near the rocks and does a little mischief, but is easily caught in traps. Along its native cliffs and canyon walls it is the especial prey of *Lynx*, *Urocyon*, and *Bassariscus*, which, with the owls, keep its ranks thinned until in many places few are left.

The remains of food scattered about the dens show a varied taste for fruit, seeds, and green things, and usually include pieces of cactus stems and fruit, mesquite, acacia, and other leguminous pods, juniper berries, acorns, and various seeds, green foliage, and flowers.

Neotoma mexicana Baird. Mexican Wood Rat.

This little dark-colored wood rat is the smallest of the species occurring in Texas, and, being mainly a Transition zone animal, has but a limited distribution in the State. It is common in the upper parts of the Davis and Guadalupe mountains, and probably occurs also high up in the Chisos Mountains, where we found old signs but failed to get specimens. In the Davis and Guadalupe mountains it lives in the rocks and cliffs where the junipers and yellow pines are mixed, and also ranges to the very tops of the mountains, where Transition species predominate. In habits it does not differ materially from *albigula*, or any of the rock-dwelling species. Its food seems to be largely acorns and the sweet berries of *Juniperus pachyphlœa*.

Sigmodon hispidus texianus (Aud. & Bach.). Texas Cotton Rat.

The cotton rats of the eastern half of Texas, while lacking the rich brown color of true *hispidus* of the Atlantic coast, are distinctly darker and more brownish gray than those of western Texas. Specimens from Gainesville, Vernon, Richmond (on the west bank of the azos), Sour Lake, Port Lavaca, Seguin, and San Antonio are rly typical, although they become slightly paler at San Antonio. ong the Gulf coast and lower Rio Grande they become still paler thout reaching the extreme of the light gray *berlandieri.*

Although not often seen the cotton rats are usually common, and times they become excessively numerous, living under cover of tall ass and weeds, in meadows, around the edges of fields, and along banks of streams and ditches. They live in bulky nests of grass

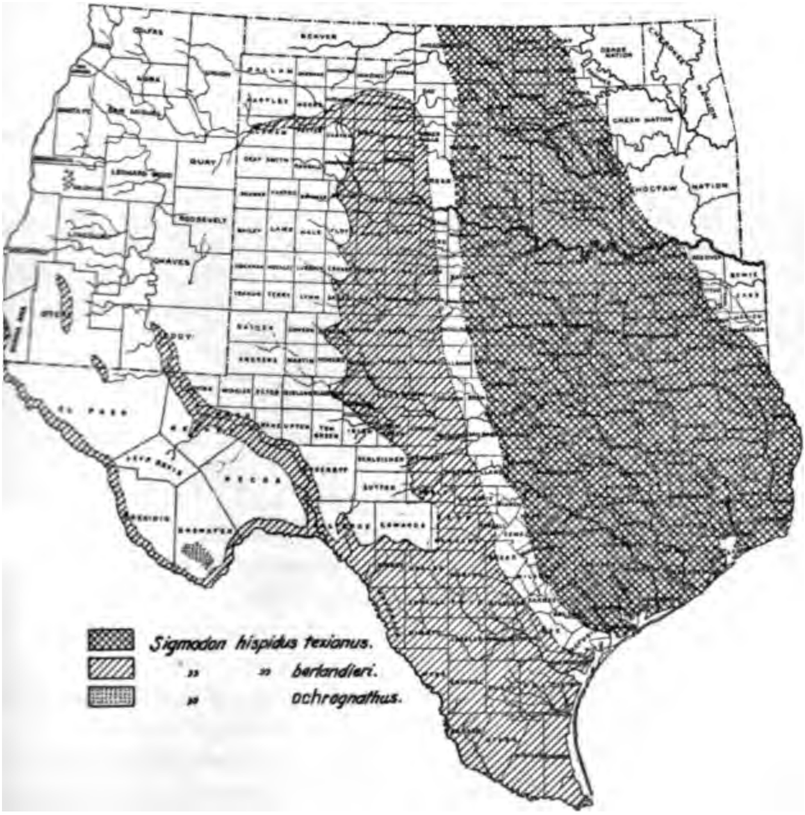

Fig. 17.—Distribution areas of cotton rats (genus *Sigmodon*).

the surface or in underground burrows, and make numerous long nways under cover of fallen grass and dense vegetation. Appartly they breed rapidly. Gaut records a female containing 8 emyos. For food they cut the green stems of grass and various plants ng their runways—eating stems, leaves, and seeds—and along the ges of grain fields they gather to feed on both green and ripening in. The amount of damage they do depends on their abundance the kind of crop attacked.

Near Seguin, in *November, 1904*, I found the cotton rats numerous around fields, in grass patches, under brush heaps and fallen weeds, in the mesquite woods, and in fact everywhere that any cover or concealment could be found. Thickets of thorny chaparral and bunches of cactus offered the most perfect protection, and even at midday the animals often were seen running about under the prickly pear. A network of their runways covers the surface of the ground and connects the numerous burrows wherever protecting cover is offered. Along the edges of cotton fields they are especially numerous, and the runways opening into the fields are often fairly lined with cotton that has been pulled from the bolls and dragged under cover where the seeds can be eaten in safety. Some cotton minus its seeds is also found scattered over the ground near the edges of fields where the animals are abundant, and a smaller amount is carried away for nests. The loss of cotton is not great in any one field, but considered over the entire range of this group of cotton rats, which coincides in a general way with the cotton-producing area of the United States and Mexico, it is considerable.

A simple and effective remedy would be to clean out the borders of fields by burning the weeds, grass, and rubbish accumulating along the fences year after year as a harbor for various rodent and insect pests and a perennial source of supply of weed seeds. If these borders were burned yearly, mowed and raked, treated with oil or chemicals to prevent weed growth, closely pastured, or thoroughly cultivated, the hawks and owls would quickly dispose of the rodents which would then have no protecting cover. Marsh hawks are abundant and constantly skim over the fields, frequently diving into the grass. Harris hawks sit on the mesquite trees and telegraph poles watching the ground below; sparrow hawks sit on the fence posts, and barred owls are heard hooting every evening from the 'moss' laden live oaks. There is no lack of enemies eager to prey on the rodents, and no simpler way of reducing the number of such pests than by the aid of their natural enemies.

As is the case with rabbits, and many other species of rodents, the abundance of the cotton rats varies greatly with the different localities during the same year, and with different years in the same locality. At times they are extremely scarce over extensive areas, and again so numerous as to suggest the plagues of voles that from time to time have overrun parts of Europe. Mr. H. P. Attwater describes one of their invasions, and the enemies that attacked them, as follows:

> In the year 1889, Sigmodons appeared suddenly in this [Bexar] county in great numbers, and were known as "tramp rats." Where they came from, or from which direction, I have been unable to find out. Thousands first appeared about the 1st of May, and were heard from in all the region for many miles around San Antonio. They were most numerous in the high, dry parts of the

[illegible] were not noticed in the lowlands along the rivers. They were [illegible] through the "chaparral," and made their nests with the [illegible] in the bunches of *Opuntia*, with a network of runways [illegible] through which they were often seen running in the [illegible] seemed to agree with the wood rats, but in the oat stacks [illegible] buildings the common brown rats fought, killed, and ate [illegible] boys killed over 100 in one afternoon in a brush fence, [illegible] their cat used to bring in from 6 to 12 every night. [illegible] occasion, when the rats were thickest, they counted 38 [illegible] one night had piled up in the wood box for the amusement [illegible]

[illegible] played particular havoc with all kinds of grain crops [illegible] but they were not good climbers, and consequently [illegible] suffered most. Some farmers lost half their corn crop [illegible] small patches were entirely destroyed.

[illegible] of 1889 and 1890 marsh hawks were very numerous [illegible] the rats. The hawks were seen skimming over the fields [illegible] the "tramps." In 1890 and 1891 short-eared owls [illegible] in the month of March stopped over to attend to the [illegible] other years I have not noticed these owls during [illegible] striped skunks were much more common than usual in 1890 [illegible] I attribute to the same cause. Rattlesnakes and other [illegible] abroad and when disturbed [illegible] rats. The large skunks and coyotes hunted [illegible] of killing rats and mice [illegible] rats stayed for about eighteen months. [illegible] they began to get scarce [illegible] they died out or "tramped" [illegible] many of them migrated [illegible] about the year 1854 [illegible]

[illegible]odon hispidus berlandieri Baird. [illegible] Cotton Rat.

[illegible] *pallidus* Mearns, Pro[illegible] M[illegible] March 15, 1897, p. 1. Type [illegible]

[illegible] gray form of the cotton rat [illegible] Mexico and western Texas [illegible] part of the Pecos Valley [illegible] dividing line can be [illegible]

The habits of this species do not [illegible] so far as modified by the [illegible] which it lives. The rat [illegible] fertile stream [illegible] usually live under the [illegible] gather it [illegible] perforate the [illegible] nests are found al[illegible] the fields and over the [illegible]

[illegible] by J. A. Allen, M[illegible] Hist. Vol. VIII, pp. 62-64, 1896.

An old female, taken at Carlsbad, N. Mex., September 9, 19 contained 11 nearly matured embryos, which is probably an unusı number, as the old one had but 10 mammæ—inguinal $\frac{1}{1}$, abdominal pectoral $\frac{3}{3}$. The front pair were between the arms, almost on t throat. Another specimen had 8 mammæ.

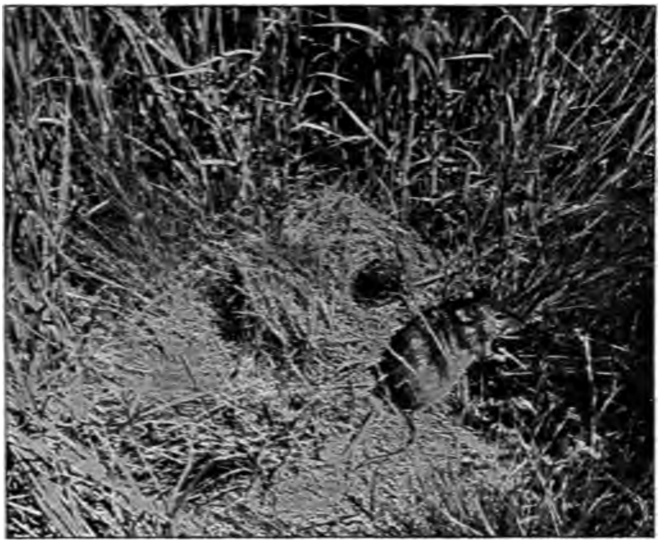

FIG. 18.—Cotton rat (dead) and nest in Johnson grass, Pecos Valley.

Besides grass, grain, and alfalfa, a few grasshoppers were fou in the stomachs of the specimens examined at Carlsbad.

Sigmodon ochrognathus Bailey. Chisos Mountain Cotton Rat.

These little yellow-nosed sigmodons are abundant in grassy pa among the oaks, nut pines, and junipers over the top of the Chi Mountain plateau at 8,000 feet altitude. They live in numer burrows and runways under short grass and feed on the stems grass and various small plants. They are mainly diurnal, and often saw them running along their little roadways in the dayti while our traps were rarely disturbed at night. On June 13, 19 besides young of several ages, two females were caught, one of wh contained four small and the other four large embryos. Some grass nests were found on the surface of the ground, but th apparently were winter nests. The runways all led to fresh burro in the ground, which were at least the summer homes of sigmodons.

As the country around the Chisos Mountains is a hot, Lower So ran desert, the species seems to be entirely isolated on top of the mou tains. Its nearest relatives are on similar isolated ranges in Mexi

Microtus mexicanus guadalupensis Bailey. Guadalupe Vole.

These little, short-tailed, snuff-brown voles are common over the brushy or grassy slopes of the Guadalupe Mountains from 7,800 to 8,500 feet in Transition zone. Unlike most species of *Microtus*, neither the presence of water nor moist nor grassy ground is required for their homes. In the head of McKittrick Canyon they live in the dry grassy parks and open places in the woods, where their runways, burrows, and old winter nests are abundant under the tall grass and weeds. Higher up on open ridges their runways wind about among stones and leaves under the shin oak and other low bushes of the driest mountain slopes, and sometimes well into the edge of the woods. The runways are distinct, well-worn little roads leading from burrows to feeding grounds or to other burrows. The summer homes seem to be entirely under ground, but unused grass nests found here and there on the surface appear to have been built for winter use under the snow. Green vegetation seems to be the principal food of this vole, and little, clean-cut sections of grass and various plant stems are found scattered along the runways on the feeding grounds.

Several old females, caught late in August, contained embryos, and at the same time young of various ages were caught in the traps.

Microtus ludovicianus Bailey. Louisiana Vole.

At Sour Lake, in southeastern Texas, Hollister secured a single specimen of this little vole, previously known only from Calcasieu Parish, La. It was caught in a brush patch at the edge of the prairie in company with the cotton rat. The prairie about Sour Lake is very similar to that just east of Lake Charles, La., where I found these little voles fairly numerous, living in the peculiar, flat mounds that are scattered over the low, damp prairie, and making their runways through the grass from one to another. Some of the mounds were perforated with a dozen or more of the little round holes, from each of which a smooth trail led away. A colony of a dozen or less of the voles, in some cases all adults, in others both adults and half-grown young, was usually occupying a mound. One female taken April 8 contained three well-developed embryos, and several others taken on the same date were giving milk. As usual in the females of this subgenus (*Pedomys*) the mammae were uniformly inguinal $\frac{2}{2}$, pectoral $\frac{1}{1}$. A few winter nests of grass were found on the surface of the ground where the standing grass had burned off, but the breeding nests apparently were all in the burrows below the surface.

Fire had recently run over most of the prairie and left the burrows exposed and the trails sharply defined over the blackened ground, but as the animals were caught as readily over the burned area as in the standing grass, the burrows are evidently a safe retreat in case of fire.

The stomachs of those caught contained only green vegetation, and along the runways grass and various small plants had been cut for food. As rice is the principal crop over these low prairies and as the ground is flooded while the rice is growing, this little vole is not likely to do serious damage.

Microtus pinetorum auricularis Bailey. Bluegrass Vole.

Two specimens from Jefferson, in northeastern Texas, prove to be nearest to this form of the subgenus *Pitymys*, although differing slightly in the more elongated skull and larger bullæ. They were caught about a mile south of town at the edge of a swampy run under a tangle of old grass and blackberry bushes. Most of their numerous runways, nests, and burrows were unused at the time the specimens were taken (June 12, 1902), which would indicate that previously the occupants had been much more numerous. There were none of the surface ridges which are usually found marking the tunnels of *pinetorum* and allied species, probably owing to the ample cover of vegetation which hid their runways. Neat little grass nests were found here and there on the surface of the ground under the leaves along the trails, and burrows entered the ground at frequent intervals. A few bits of grass and tender plant stems were the only traces of food noticed along the runways.

A flat skin and smashed skull, apparently of this subspecies, sent in 1895 to the Department from Baron Springs, near Fredericksburg, Tex., by Fritz Grosse, formed the only previous record of the subgenus from Texas, although it ranges over the southeastern United States and reappears in Vera Cruz, Mexico.

Fiber zibethicus (Linn.). Muskrat.

Nine specimens of the muskrat from Lipscomb and three from Canadian fail to show any cranial characters that will separate them from typical *zibethicus*, assuming that New York, Massachusetts, and Minnesota specimens are typical; but size and cranial characters separate them widely from their near neighbors, *ripensis*, of the Pecos Valley. The pelage of these 12 specimens, which were collected June 25 to July 16, is worn, faded, and very pale, while the more northern specimens, collected in fall, winter, and spring, are comparatively fresh and dark. I have seen, however, equally pale summer specimens at Elk River, Minnesota.

Lipscomb and Canadian are practically at the junction of Upper and Lower Sonoran zones, and apparently mark the extreme southern limit of range of *zibethicus*. At Canadian, Howell reports muskrats as "numerous at Clear Creek, living in the fish ponds and irrigation ditches, where they cause considerable trouble by tunneling into the banks and thus releasing the water." At Lipscomb he says:

> They are found in small numbers in nearly all the small grassy creeks throughout this region. I secured two on Cottonwood Creek, 5 miles east of

[illegible] man who went fishing there a few days later saw three more. He [illegible] enough to one, which was feeding on the bank, to hit it [illegible] pole, and after it had retreated into a hole in the bank he [illegible] out and swam away. I set traps at this place later. [illegible] a creek known as First Creek, flowing into Wolf [illegible] 25 miles west of Lipscomb, I found the muskrats really [illegible] conditions being peculiarly favorable for them. This [illegible] series of wide and deep holes, with abundance of marsh [illegible] their borders, and partially filled with a flowering water [illegible] *[illegible]atum*) upon which the muskrats feed. Their trails [illegible] in every direction through this mass of floating vegeta[illegible] walk a half mile along the creek at any time of [illegible] or more of the rats. Their favorite feeding times are [illegible] sunset, and at these times I sometimes saw eight or ten [illegible]. They swim out from the bank into the water plant, [illegible] the surface while they feed. Several which I shot had [illegible] in their mouths. These rats do not build nests as [illegible] do, but live entirely in holes in the banks, entering either [illegible] the surface of the water. When alarmed they dive and take [illegible] these hidden retreats. When I first began to hunt them they [illegible] wary than after several had been killed, and if one were to [illegible] the bank they would feed and move about unconcernedly. I [illegible] evenings' hunting besides wounding several which [illegible] in traps, except [illegible] common for miles up [illegible] June 19 to July 10, [illegible]

zibethicus ripensis Bailey. Pecos River Muskrat.

[illegible] colored muskrat live[illegible] the whole length of the Pecos River [illegible] along the Rio Grande near [illegible] of the Pecos. [illegible] a few unmistakable [illegible] Rio Grande near Del R[illegible] in the Pecos Canyon [illegible] Hollister collected [illegible]. They were common [illegible] Creek, and Gaut collected [illegible] Rosa, N. Mex. They are [illegible] in the river and irrigat[illegible] below the surface of [illegible] chamber, often [illegible] fragments [illegible] advantage of [illegible] largely [illegible] before dark and [illegible] up roots and [illegible], and after eating them [illegible] rejected and [illegible] parts [illegible] that [illegible]. At the slightest alarm they [illegible] with a plash and are [illegible].

no more, either coming up at some distant point or hiding under the banks or in their nests.

In several places their burrows were found in the banks of the large irrigation canals, where no doubt they cause some of the mysterious breaks that occur in the ditches.

Castor canadensis texensis subsp. nov. Texas Beaver.

Type from Cummings Creek, Colorado County, Tex., No. 135744, U. S. Nat. Mus., Biological Survey Coll. Original number, 5139, X Catalogue. Made over from a mounted specimen purchased of A. Hambold, New Ulm, Tex. Caught in Cummings Creek by Florence Brune, Dec. 25, 1900, and kept alive until Jan. 10, 1901. Sex not indicated. Old and large.

Characters.—Coloration pale, as in *frondator*, possibly due in part to fading.

Skull.—Sagittal crest short and lateral ridges lyrate or spreading even in extreme old age; supraoccipital crest doubly curved, nasals long, spatulate, and tapering to narrow point posteriorly.

Measurements.—Type: Hind foot, measured dry, 174; naked portion of tail, measured dry, 265 long, 113 wide.

Skull of type.—Basal length, 136; nasals, 57; breadth of nasals, 30; zygomatic breadth, 107; interorbital breadth, 29; mastoid breadth, 67; alveolar length of upper molar series, 32.

Specimens examined.—Type, skin, and skull, and two skulls from Cypress Mills, Blanco County, farther up the Colorado River.

Remarks.—The characters shown by these three specimens are so well marked and uniform as to justify describing the subspecies, even on so scanty material. Whether the beaver of other streams north and south of the Colorado Valley of eastern Texas are the same can be settled only by specimens; but I have grouped the scattered notes and records for all but the Rio Grande and Pecos valleys of Texas under this form.

Beaver are still found in many of the streams of eastern Texas, especially in the larger rivers, where deep water and steep banks afford protection against relentless trapping. In 1892, at Arthur, in northeastern Texas, I was informed that they were fairly common along the Red River and that trappers caught a few each year. In 1902, at Texarkana, Oberholser was told that a few were still found in the Red River, and in 1901, at Mobeetie, was informed that they were common in Sweetwater Creek, a branch of the North Fork of the Red River. In 1903 Howell reported them as still common in the Sweetwater and Gage creeks not far from Mobeetie; also in the Wichita and Canadian rivers not far from Canadian. In the Colorado River a few were reported in 1892, by B. H. Dutcher, about 10 miles below Colorado City; again, in 1902, they were reported by Oberholser as rare near Austin and Elgin, while in 1892 Lloyd found trees girdled by them along the Colorado in Matagorda County. In 1901 Oberholser saw a skin that was brought into San Angelo, and was probably taken near there on the Concho, a branch of the Colorado. In 1902 he reported beaver in the Brazos as rare in the region of Brenham; in the Trinity River as occurring at Long Lake; in the Neches as occurring rarely in the river and bayous in the region of Beaumont, and as occurring in some of the larger streams about Jasper (probably branches of the Neches or Sabine). In 1899, at Lake Charles, La., I was told that trappers came down the Sabine River every winter, and among other furs brought some beaver. In the Big Thicket, in 1904, Dan Griffin told me that beaver were abundant a few years before in Village Creek, Polk County. In 1900 Oberholser was told of a colony of beaver 40 or 45 miles northwest of Uvalde, which would place them on the headwaters of the Nueces. In 1902 Mr. Gething, of Rock Springs, told me of a fine beaver skin that he bought the previous winter, which was obtained on the headwaters of the Rio Frio.

Through the kindness of Mr. Attwater, I am able to give the following interesting notes from his correspondence with Mr. J. F. Leyendeker, who writes from Frelsburg, Tex., under date of June 5, 1904:

> I have your favor of the 3d instant and will cheerfully give you all the information at my command in regard to beavers in this section of Texas. I have heard of beavers and seen them in the Colorado River and Cummings Creek, a tributary of the Colorado River, which has its source near Giddings, in Lee County, and empties into the Colorado River in the big bend about 2 miles nearly north of the town of Columbus. It is quite a large stream, with many deep-water holes or pools, sometimes over half a mile long and from a few to 10 or 12 feet deep.
>
> The first beaver I ever saw was a very large male, weighing over 40 pounds, killed by my brother in said creek, in February or March, 1866. But few were noticed until after the big overflow of the Colorado River in 1869 and 1870, after which they were more numerous, especially where the creek passed through Mr. F. A. Brune's plantation, about 7 miles nearly north of Columbus. In this place there was quite a colony of the beavers, in fact so many that they did considerable damage to Mr. Brune's growing corn crop by cutting off the stalks, and I suppose using the ears as food. About six or seven years ago they constructed a dam across the creek, 40 or 50 feet long, in Mr. Brune's field, using blood weeds mostly and some other material for that purpose. This dam was perhaps a foot to 15 inches high, and strong and compact, but of course the first rise in the creek washed it away.
>
> Mr. Emil Brune, a son of F. A. Brune, was here yesterday, and, after questioning him in regard to beavers, he said that he trapped six or seven, among these the one sent to San Antonio in January or February two years ago he did not recollect the exact date. He also stated that while fishing he broke through into a beaver cave and there found four young beavers, which he carried home, but they soon died. I have been informed that there are still some beavers in Cummings Creek, near Mr. Justin Stein's place, a few miles nearly west of Frelsburg. It is also said that there are still some beavers in

the Colorado River, near Mr. William Schulenburg's place, about 4 miles above the town of Columbus.

In 1872, while surveying land 18 miles above Fredericksburg, I found the beaver quite abundant in the Perdinales and White Oak creeks, and I have no doubt that some may be found there yet.

Castor canadensis frondator Mearns. Broad-tailed Beaver.

Beaver are still found in many places along the Rio Grande, Pecos, and Devils rivers. In 1891 Lloyd reported them as common on the Mexican side of the Rio Grande 12 miles below Matamoras, and in 1900 at Brownsville I was told that a good many beaver were caught in the river above there every winter. In 1902 a fine specimen was taken by Goldman at Camargo, on the Mexican side of the river, and Mr. F. B. Armstrong told Mr. Nelson that the live beaver sent to the New York Zoological Gardens were caught in the Lower Rio Grande within 8 miles of the mouth. In the summer of 1901 we found fresh beaver 'sign' near Boquillas, in the Great Bend, and in the following winter trappers reported a good many beaver caught in the Rio Grande, Pecos, and Devils rivers, but stated that their numbers were rapidly decreasing. Still, one of these trappers assured me that he expected to make $500 on a trapping trip down the Rio Grande from Langtry to Brownsville the next winter, and was counting on getting $5 for each of his beaver skins.

In the winter of 1902–3 one trapper was reported to have caught 200 beaver on the Rio Grande between the Grand Canyon and Del Rio.

In the summer of 1902 I visited a beaver pond in the Pecos River Canyon, where apparently a good-sized family of beavers was living. This pond was a natural reservoir in a deep, sheer, walled side canyon, and was filled from the river in times of flood until it formed a deep lake a hundred yards wide and half a mile long, held in at the narrow outlet by a dam not over 30 feet long and at the time of my visit only 2 or 3 feet high. This pond—or lake, as it is called—with steep earth banks on one side, overhung by willow trees, with deep holes, big bowlders, and little islands, is an ideal spot for a beaver home. The willows furnish the principal food of the beaver, and have for ages, as shown by the old stumps and fallen timber along the shore, together with the freshly cut trees and gnawed bark and branches. The beaver often cut a tree so that it falls into the water, leaving the base anchored to the stump, and then at their leisure gnaw off the bark and cut the branches. Many trees fall inland, however, and in that case are abandoned, or else are well trimmed of branches and bark or cut into sections and carried away. The banks offer such good retreats that apparently no houses have been built around the lake, and at the time of my visit the river was high and the top of the dam was 2 feet under water. The photographs taken [illegible] pond and its surroundings showed some of the cut trees, though [illegible] of the beaver's work.

A beaver house near the head of Devils River was built on the bank [illegible] bottomed pond, where the clear, blue water spread [illegible] little lake full of fish and margined in places with [illegible] willows. The house was placed on a rocky bank just [illegible] water and was mainly composed of old beaver cuttings [illegible] and branches cut to a convenient length for transportation. [illegible] were simply piled up in a mound some 8 or 10 feet wide and [illegible] 4 feet high without mud or other filling, but when I tried [illegible] a doorway to the nest I found them interlaced in a snarl that was not easily broken through. The house had the appearance of a [illegible] heap or a pile of driftwood on the bank, and might have been passed unnoticed save for its position and the gnawed ends of [illegible]. Apparently it was either new or merely the summer house of one old beaver, and consequently was small and not substantially built. Its walls were so thin that as my shoes touched the [illegible] edge at the back I distinctly heard the beaver get up and [illegible] out of his nest into the water. As he left the house I caught a glimpse of him deep under the water, and for some time followed his [illegible] of travel by the line of bubbles that came to the surface as he [illegible] down the lake or came back near the house to watch [illegible] to return and finish his nap. At no time did he show [illegible] at the surface, and the glimpses I had of him were at a depth of [illegible] feet, where he looked like a great fish dashing along with the speed of a racing boat. Quietly withdrawing, I returned at [illegible] watch for his appearance. Just before reaching the [illegible] I saw a [illegible] head with short stubby [illegible] from the water [illegible] middle of the lake and he [illegible] for a few [illegible] toward the bank a few rods [illegible] before reaching it. A moment [illegible] to the house, where I [illegible] few [illegible] the beaver again came to the [illegible] apparently a willow root from under the bank. [illegible] around a big bowlder [illegible] a rod from shore [illegible] he dived to his [illegible] A [illegible] I [illegible] enter the house [illegible] I [illegible] chisel teeth [illegible] finished his evening [illegible] another stir inside, followed [illegible] Then a line of bubbles [illegible] along the [illegible] water for several rods from [illegible] the [illegible] the surface. After remaining quiet for about [illegible] the beaver started back to the same feeding spot at the bank and again dived at the base of the willow tree. For about three minutes he remained below, and then came up again with food and started for the return trip to the house. As dusk was now deepening and as I fully realized the importance of securing a specimen from a river where no beaver had ever been collected, I dared not wait longer, but decided to shoot him with buckshot, as the light was far too dim for rifle sights. For fear of injuring his skull I aimed for his neck, which was deeper under water than I counted on. At the report a thundering splash told that he was not dead. A second later he leaped from the water close to my feet and at a single dash crossed a narrow point of land at the edge of his house and disappeared in the deep water, followed by a line of bubbles that shot up the pond. Such strength, such powerful bounds, and racehorse speed I had never dreamed of in the clumsy looking beaver. I had emptied my pockets of notebook and cash, to be ready to dive for the prize in case he sank, but I would as soon have jumped on a grizzly bear in his native gulch as this live beaver in the water. A little later a loud slap of his tail on the water far up the pond sounded like a "come on," and the old trappers tell me that this is really a fighting challenge. I waited until after dark without further developments, and then picked my way over the rocks for the long 2 miles back to camp. In the morning the old moon was still shining, and I was at the beaver house before day began to break, but there was no beaver either in the house or outside. He had moved, and probably had not returned to that part of the river since his fright. All that was left for me to do was to examine and photograph his house. With a good deal of difficulty I forced an opening through the stick wall so that I could put my arm in and feel the damp walls of the chamber, the big round hole where the water came just to the edge of his bed, and the bed of grass and weeds scattered over with peeled branchlets and roots of willow. No trace of other food was found. It was evident from the size of the house and the nest chamber that this was the bachelor quarters of an old beaver. Carefully closing the opening, I left the house as nearly as possible as I found it.

In talking with John Seawel, an old beaver trapper, I asked him why it would not pay to protect the beaver in a pond like that above the Pecos Bridge and let them multiply. The idea was not new to him, for he had talked it over with other trappers and all agreed that it was not worth trying, because they considered the beaver naturally ferocious, to a great extent solitary, and a slow breeder. Seawel says that two old beavers rarely live together in one house or even in one small pond; that they fight and chase away any newcomers; that if a family grows up and is undisturbed in a pond or a deep bend of the river, its members keep all others of the species away, and that they *attack and kill* any one of their number that is found in a trap or is sick or crippled. While he thinks that systematic breeding for fur is out of the question, he admits that the beaver should be protected all over the country, until the few that remain increase and restock the rivers. There are probably more beaver in the Rio Grande and Colorado rivers than in any other southern streams, and it is important that Mexico should cooperate with the United States in protection of the animal that has played so important a part in the history of the development of the country.

Liomys texensis Merriam. Spiny Pocket Rat.

H[illegible] Allen, Bul. Am. Mus. Nat. Hist., III, 1891, p. 268 (in part; [illegible] from Brownsville).

A large series of these little spiny pocket rats has been collected in the region about the mouth of the Rio Grande, at Brownsville, Matamoras, and Lomita.

Loring reports them at Brownsville as "common in the timber under logs and the roots of trees;" and Lloyd says they are "found at Lomita in the densest brush on the ridges forming the old banks of the river, and around old corrals." He adds:

> The habit of throwing out a white clayey mound like the gophers attracts attention, and although the mound may be a month old, by cleaning out a hole and setting a trap in it you will in time capture the occupant. The ordinary burrows are generally covered up by fallen leaves, which in some instances seem to be placed there by the occupants. They are strictly nocturnal in their habits and feed on the seeds of hackberry, mesquite, and various other trees. Young and old inhabit the burrows together.

Geomys breviceps Baird. Louisiana Gopher.

These little, dark colored pocket gophers, usually known throughout their range as 'salamanders,' extend from Louisiana into eastern Texas and, with considerable variation, westward to Navasota, Bre[illegible], Milano, Peoria, Decatur, and Gainesville, or a little beyond the ninety-seventh meridian, thus inhabiting most of the eastern timbered area of Texas, to the edge of the semiarid mesquite country, where they grade into a larger, paler form.

Their range is broken and irregular. Across sandy ridges they are abundant for miles, and then across miles of [illegible] bottom lands or wide stretches of black waxy land [illegible] are wanting. They live impartially in timber and open [illegible] and are rarely found on clay or hard [illegible] the softest and mellowest land. [illegible] mainly in the large flat mounds [illegible] and if not responsible for the construction of [illegible] mounds, at least constantly add to them the earth brought [illegible] their burrows. Owing to the small size of these gophers, their scattered distribution and choice of poor, sandy soil for their [illegible] work, there is comparatively little complaint of their mischief. In the heavier, better soil of cultivated fields they are not so common, and they throw out fewer and smaller mounds, but in pastures, potato fields, gardens, and orchards they sometimes do serious damage, besides leaving unsightly mounds over lawns and parks. They are easily trapped and there is no excuse for allowing them to injure crops or trees. A field once cleaned out will not be repopulated to any extent for several years, as the animals rarely travel except by extending their underground tunnels.

Like all species of the genus, they are strictly vegetarian in diet and cleanly in habits. Their flesh is sweeter, better flavored, and more delicate than that of squirrel or rabbit, and their small size is the only objection to their use as a table delicacy.

Geomys breviceps sagittalis Merriam. White-throated Pocket Gopher.

This white-throated form of the *breviceps* group seems to have a very local distribution on the coast prairie west of Galveston Bay. There are specimens from Clear Creek, Arcadia, and Virginia Point. I failed to find any trace of this gopher on Galveston Island or the point east of the bay at Bolivar. Along the Santa Fe Railroad from Virginia Point to Houston they are common most of the way over the prairie, where low mounds furnish favorite burrowing places. In certain localities they are numerous, and there are many complaints of the mischief they do, especially to orchards.

On the ranch of Mr. Lee Dick, at Virginia Point, they had entirely destroyed an orchard of 200 six-year old fig trees in bearing. Most of the dead trees had been piled up over the fence, where I examined them and found that all the small roots had been cut off, and in many cases the tap root where it was 2 or 3 inches in diameter. A few dead trees that were still standing were tipped over and the roots found in the same condition—all bearing the unmistakable marks of the teeth of the gopher. Five hundred dollars would be a small cash value to place on this lot of trees, and probably a dozen gophers had done the mischief. Mr. Dick had wasted a good deal of time trying to shoot them, but he had given up and said the people might as well move out and let the gophers have the country. I set nine No. 0 steel traps in this orchard patch, and a few hours later took out of them seven gophers. Not more than two or three remained in the field. The owner then acknowledged that with half a dozen traps a few hours' work might have freed his orchard of gophers, and that the loss of his trees was wholly unnecessary. His claim, moreover, that other gophers would soon come in from the surrounding prairie is true only to a very limited extent, and the immigration could be entirely prevented by trapping in the immediate vicinity of the field.

Geomys breviceps attwateri Merriam. Attwater Pocket Gopher.

This pocket gopher inhabits the islands and coast prairie between the mouth of the Colorado River and Nueces Bay and extends inland nearly to San Antonio. It is larger and lighter colored than typical *breviceps* and inhabits a decidedly more arid region.

Mr. H. P. Attwater has furnished the following interesting notes on their habits at Rockport:[a]

> The animals are very abundant all over the peninsula in Aransas County wherever the soil is sandy. There is hardly a foot of land that has not been 'plowed' several times over by gophers, and I believe the fertility of some sections has been greatly improved by them, by bringing the poorer soil up to the top. I have noticed that the richer the land the richer the gophers. Of course they do considerable damage to vegetable crops, especially to young fruit trees and cuttings just rooting. The samples sent you of mulberry trees cut by gophers were from the Faulkners' ranch, on St. Charles peninsula, in the eastern part of the county. Mr. Samuel Walker, the manager of the ranch, told me that he killed over 250 gophers in his young pear orchard between the 1st of March and April 15, 1893. This orchard was set out where sweet potatoes had grown the year before, and they came up again and covered the ground, and I think the potatoes attracted the gophers in the first place more than the pear trees.

Geomys breviceps llanensis subsp. nov. Mesquite Plains Gopher.

Type from Llano, Tex., No. 97086, ♂ ad., U. S. Nat. Mus., Biological Survey Coll., May 15, 1899. Vernon Bailey. Original No. 6912.

General characters.—Similar to *breviceps*, but larger and lighter colored with more arched skull.

Color.—Upper parts light liver brown, in three of the females much darker, with dusky over the back; lower parts creamy or buffy white.

Skull.—Long and slender, with very narrow braincase and rostrum and small bullæ as in *breviceps*, but with narrower and arched instead of convex interorbital region, nasals not sharply emarginate or abruptly constricted posteriorly; occiput sloping instead of abruptly truncate.

Measurements.—Type: Total length, 270; tail, 88; hind foot, 32. Adult male topotype: Total length, 270; tail, 82; hind foot, 32. Adult female: Total length, 230; tail, 71; hind foot, 30.

Skull of type.—Basal length, 44.3; zygomatic breadth, 29.6; mastoid breadth, 25; interorbital breadth, 6.3; breadth of muzzle at root of zygoma, 9; alveolar length of upper molar series, 8.5.

Remarks.—While closely resembling *texensis* externally and while the ranges of the two almost or quite meet it needs but a cursory examination of the skulls to show that this form has no connection with that species. It is a large, light-colored plains form of *brevi-*

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[a] Merriam, N. Am. Fauna No. 8, p. 136, 1895.

ceps which follows up the river valleys from eastern Texas and becomes differentiated as it enters the open country. Specimens from Colorado, Stanton, Brazos, Childress, Vernon, Newlin, Canadian, Lipscomb, and Tascosa, Tex., are referable to it. Two females from Brazos are clearly intermediate between the present form and *breviceps*. In general contour of skull and especially in slender rostrum it resembles *phalax*, but in the slender audital bullæ and small mastoids and consequent narrow base of skull it differs widely from that species.

So far as known at present the range of the form in Texas extends mainly along strips of sandy soil in the Llano, Colorado, Brazos, Red, and Canadian river valleys, in a region of scattered mesquite bushes, but does not reach the Staked Plains and rarely extends over the hard-soiled ridges between stream valleys. Gaut caught one gopher two miles south of Washburn, but could find no other trace of them in the country around there. At Lipscomb Howell says "they are plentiful both on the prairie and in the sandy bottoms. Their burrows are very difficult to open, as they are usually closed for a distance of about 18 inches below the surface, at which depth they take a horizontal direction."

Owing to their scattered distribution over a sparsely settled stock country, these gophers are at present of little economic importance, but as irrigation reclaims the mellow soil of these semiarid bottom lands they will constitute one of the problems to be dealt with by the farmers.

Geomys texensis Merriam. Texas Pocket Gopher.

This little, brown-backed, white-bellied gopher inhabits a few spots in central and western Texas. A series of 28 specimens in the Merriam collection from Mason, the type locality, indicates its abundance there, while a single specimen from each of two sandy patches along the Rio Grande, at Del Rio and at the mouth of Sycamore Creek, suggests a scattered distribution along this part of the Rio Grande Valley and a probable former extension of range up the Devils River and across to the head of the Llano as far as Mason. The country immediately north and south of its range has been pretty thoroughly worked without disclosing any species of *Geomys*. We succeeded in catching only *Cratogeomys* and *Thomomys* along Devils River, so at the present time the Mason and Rio Grande colonies seem to be widely isolated.

Geomys arenarius Merriam. Desert Pocket Gopher.

This gopher is common on both sides of the river at El Paso. Specimens have been taken at Las Cruces and Deming, N. Mex., and in 1902 Cary caught one that is almost typical *arenarius* in the sand hills near Monahans, Tex., at the east edge of the Pecos Valley.

This last locality can hardly be considered a part of the general range of the species, but probably marks a long isolated colony.

At El Paso gophers are common on the sandy river bottoms just below the town, where they throw up numerous and very large mounds of the mellow sand. I have never been able to find one in the irrigated orchards and fields, for there the water fills their burrows and drowns or drives them out. Loring reports them as especially abundant in railroad grades and banks of irrigation ditches at El Paso, and he caught seven in one day in the railroad grade a few miles north of Las Cruces, N. Mex. He says: "When pulled from their holes they hissed violently and when two were placed together they fought like bulldogs."

Geomys personatus True. Padre Island Pocket Gopher.

This large, light-colored pocket gopher inhabits the central and northern part of Padre Island, a sandy belt along the mainland in Cameron County, and a sandy area near Carrizo, on the Rio Grande. Apparently it does not inhabit the lower Rio Grande Valley, as Lloyd did not find any trace of it between Carrizo and Brownsville nor between Brownsville and Sauz. On a trip from Corpus Christi to Brownsville I found its hills abundant across the sandy country between Olmos Creek and Sauz Ranch, but entirely wanting in the baked clay soil outside of these limits. At Carrizo Lloyd found them in only one patch of sandy soil, and there is nothing to show that they have a continuous range across from this point to Cameron County. On the light sandy soil and drifting dunes where these gophers abound there are no crops to be injured.

On Padre Island, Lloyd says:

> Their habits are in some respects peculiar, owing, perhaps, to the soft sand, that caves in on them, for they fill up their tunnels after throwing out the earth to a distance of 1 and sometimes 2 yards. They can not go very deep in the flats or they would reach water; in fact, the water filled some of the tunnels for about a foot until they curved upward.

Geomys personatus fallax Merriam. Nueces Pocket Gopher.

Since this relatively small and dark subspecies of *personatus* was described I have been over its range pretty thoroughly and am convinced that it is an isolated and very local form, inhabiting the sandy strips near the coast between Nueces Bay and the Salt Lagoon at the mouth of San Fernando Creek and extending a short distance up the south side of the Nueces River. Except for very limited sandy strips along the coast and some of the stream shores the country is characterized by a tenacious black clay soil so sticky when wet and so hard when dry that no burrowing rodents inhabit it. From Corpus Christi west to San Fernando Creek we did not see any signs of gophers nor any soil that they could live in. Nueces Bay and the Nueces River, with its flood bottoms, cut off this range entirely from that of *attwateri* on the north, while the Laguna Madre, Salt Lagoon, and streams radiating from them separate as effectually the range from that of *personatus* on the south. Two females from Laredo agree more nearly with *fallax* than with any other form, but probably the range of this colony has no connection with that of *fallax* of the Nueces Bay region.

In the region of Corpus Christi the sandy soil is especially desirable for growing early vegetables, and the presence of the gophers is a source of much annoyance and considerable loss to the farmers.

Geomys lutescens Merriam. Yellow Pocket Gopher.

Two specimens of barely adult females from near Texline agree with *lutescens* in external characters, but possess cranial characters that suggest the possibility of a local subspecies. Howell reported numerous burrows in a range of sand hills 15 miles east of Texline, where the two specimens were caught, but elsewhere in the region none were seen.

Cratogeomys castanops (Baird). Chestnut-faced Pocket Gopher.

This, the largest of the Texas pocket gophers, with the single-grooved upper incisor, is common in Lower Sonoran zone and the edge of Upper Sonoran of western Texas from Eagle Pass, the headwaters of Devils River, Fort Lancaster, Big Springs, Hail Center, and Tascosa westward. A few are scattered here and there over the Staked Plains, but generally they inhabit valleys with fertile and mellow soil lower down, becoming very numerous and troublesome in some of the cultivated land. Their concentration on the best soil, together with the large size of their burrows and mounds, makes them one of the most injurious of the gopher family.

In habits they do not differ materially from the various species of *Geomys*, except in being more alert and possibly more diurnal. During the day they are often seen at the mouths of their burrows pushing out earth, at which times their comparatively large eyes are conspicuous, bright, and alert. They see a person much more quickly and at a greater distance than do most species of *Geomys* or *Thomomys*, and hence move about somewhat more freely at the entrance of the burrow. Still no protective measures are neglected, and the burrows are always promptly closed and packed with earth, sometimes for a distance of 2 or 3 feet back from the main tunnel. The mounds of these gophers often contain a bushel or more of earth, and when located in a meadow or alfalfa field they cover and destroy much of the crop, besides interfering with machinery in harvesting. The greatest damage caused by the gophers, however, is in cutting off roots, especially in such crops as alfalfa and garden vegetables, but most of all in the case of fruit trees. In many instances small orchards have been almost destroyed by a few gophers that could have been trapped with little trouble. They are so easily caught in steel traps that it would hardly pay to poison them except on a large ranch, though undoubtedly they could be poisoned in the same way as other gophers by dropping raisins, prunes, soaked corn, or small potatoes containing strychnine into the burrow and then closing the opening from above. On a cattle ranch in the foothills of the Davis Mountains I found where a couple of the gophers were working in dangerous proximity to the roots of a half dozen flourishing and fruit-laden peach trees growing near the windmill reservoir, while in the 3-acre patch of alfalfa just below, the hills of the animals were numerous. Under a neighboring cliff where a pair of horned owls had raised their young the same year I counted 20 skulls of *Cratogeomys* among bones of other rodents, but for fear these owls would catch the chickens one had been killed by the ranchmen and the others driven away.

Thomomys fulvus (Woodhouse). Fulvous Pocket Gopher.

The pocket gophers from the Transition zone summit of the Guadalupe Mountains, while differing slightly from typical *fulvus*, do not seem to require separation from that wide ranging species. They are abundant over the timbered slopes of these mountains in Transition zone and often in places where the yellow pines are mixed with nut pines and junipers. They were common in the head of Dog Canyon, at 7,000 feet, the head of McKittrick Canyon, at 8,000 feet, and on top of the ridges, from 7,000 to 9,000 feet, and probably to the highest peaks, at 9,500 feet. There, as elsewhere, they inhabit partly forested slopes covered with abundant vegetation. They make endless tunnels and throw up numerous hills, often working among the rocks and constantly bringing to the surface the rich, mellow soil. In walking over the mountain slopes one's feet break into the burrows that honeycomb the soil beneath. The long, ropelike ridges of dry earth on the surface of the ground show where the gophers have worked in winter under the snow and filled snow tunnels with the earth brought up from below.

In mountain districts the gophers can do no possible harm, and besides their beneficial effect on the soil their underground tunnels catch and carry into the ground much of the water that would otherwise run off the surface and be lost.

Thomomys fulvus texensis Bailey. Davis Mountain Pocket Gopher.

This little, dark-brown gopher inhabits the timbered part of the Davis Mountains in Transition zone and in at least the upper edge of Upper Sonoran, ranging from about 5,000 feet up through the juniper and yellow-pine belts to the highest part of the mountains. The highest point where their mounds were seen was on the main ridge of Mount Livermore, at about 8,200 feet. In the gulches they come down nearly to Fort Davis. In habits as well as general appearance and zonal position they are much like *fulvus*, living in a region of abundant vegetation and considerable rainfall and burrowing in the rich mold on stony mountain slopes or in open grassy parks. For a part of each year they live under the snow. The sides of the mountains are plowed over by them, and the mellow earth that is brought up from between the stones is washed down by the rains and deposited in the gulches below, where other gophers, with their endless underground tunnels, are mixing and stirring the soil and steadily improving it for cultivation. The service to man thus performed by these little animals is not to be lightly estimated.

In this region of extensive stock ranges and very limited agriculture the gopher will never prove a serious pest. The few that get into gardens and orchards are easily caught in traps, while those outside go on cultivating the soil without harming anything. With the larger *Cratogeomys* of the lower country, before mentioned, the case is different.

Thomomys baileyi Merriam. Sierra Blanca Pocket Gopher.

This unique little gopher is known only from the specimens collected at Sierra Blanca on the open arid plain at the junction of Upper and Lower Sonoran zones. It is probably an Upper Sonoran species of the open country, as no trace of any *Thomomys* has been found in the big valley to the south and east, while its hills are common over the mesas and low mountains northeast of Sierra Blanca and north of Van Horn. Its characters do not suggest relationship with its nearest neighbor *lachuguilla* from the Lower Sonoran, Rio Grande Valley, or with any other of the surrounding species. It probably represents a long-isolated colony of very limited distribution.

Thomomys aureus lachuguilla Bailey. Lachuguilla Gopher.

This little gopher inhabits the hottest and most arid part of western Texas. It lives on the barren mesas along the east side of the Rio Grande Valley, from El Paso to the Great Bend country, where the principal vegetation consists of scattered desert shrubs, cactus, yuccas, and agaves. Its little mounds are distributed over the baked and stony mesas, sometimes in long lines across barren strips, but usually grouped around the base of a bunch of cactus or a group of yuccas or agaves, the roots of which furnish it with both food and drink. The roots, stems, and leaves of apparently every plant encountered are eaten, but the favorite and principal food of the species is the tender, starchy caudex of the little *Agave lecheguilla*, a plant protected by sharp hooks and rigid spines from every outside attack, but wholly unprotected from below. The gophers burrow under and eat out the whole pineapple-like heart of the stem until the leaves and flower stalk dry up and topple over, while they burrow along to the next plant in their way, often leaving a long trail of dead agaves to mark their course. As the agave is extremely abundant and generally is considered a nuisance, the gophers are given credit for good work in destroying it, but if its fiber proves of value, as seems probable, the verdict in favor of the gopher must be reversed.

Thomomys perditus Merriam. Little Gray Pocket Gopher.

These little gray gophers are scattered sparingly over the high, stony mesa from Comstock to the Pecos High Bridge and Langtry, and still more sparingly to the head of Devils River. Farther east they do not seem to have a continuous range, but their hills were seen at points east and west of Rock Springs, and a specimen was taken on the high plain 35 miles east of Rock Springs, and another in the Castle Mountains in Crockett County.

The animals are not only scarce, but difficult to catch, as they live in scanty, stony soil where their little mounds are often mainly composed of stones instead of earth, while their tunnels become blocked by stones and are soon abandoned. Sometimes the doorways are left open apparently for lack of soil to close them, or because the gopher has abandoned the burrow in the hope of finding more favorable conditions elsewhere; sometimes they are merely blocked by two or three stones, but usually they are closed to a slight depth. The burrows do not extend far and the hills thrown up are few and small. Sometimes the old ones are almost obliterated before a fresh one is thrown up, and I have caught the gophers where the nearest hill appeared to be a month old.

Most of the food of the gopher is procured under ground from various roots, largely of yucca and sotol, or from the inside fleshy parts of cactus, *Cereus*, *Echinocactus*, and *Cactus*, which they burrow into and eat out from below. The roots and starchy base of a yucca or sotol will furnish food for an individual apparently for a week or more.

Perognathus hispidus Baird. Hispid Pocket Mouse.

This big pocket mouse is common in the more or less brushy part of the Lower Sonoran zone over southern Texas and the adjoining part of Mexico. In Texas it ranges from Brownsville north to O'Connorport, Cuero, Seguin, Llano, and probably, judging by immature specimens, to Brazos and Henrietta on the east, and to Del Rio on the west. It is less partial to open ground than most species of the genus, and is often caught in brushy or grassy places among the mesquite, at the edge of a thicket, along the fence at the edge of a field, on a weedy sand flat, or even in the midst of a corn or cotton field.

Some of the burrows suggest inch auger holes bored straight down into the ground, with no trace of earth that has been brought out; others are closed flush with the surface of the ground so as to be almost invisible, while others are closed 2 or 3 inches below the surface. At almost every den, however, there is a mound of earth that has been brought out of the burrows and heaped up, sometimes to the size of a gopher or mole hill, over the closed main entrance. This fact probably accounts for the absence of earth at other burrows that have been opened out from the main tunnel.

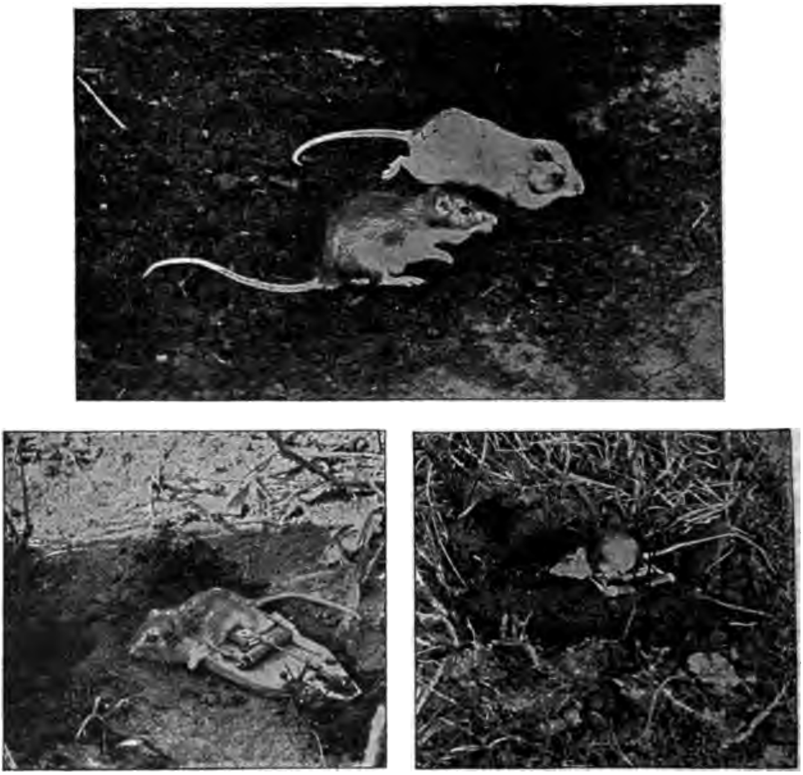

Fig. 19.—Pocket mice (*Perognathus hispidus*) caught in traps at Seguin, Texas.

At Seguin, in Guadalupe County, in November, 1904, I found these big pocket mice unusually abundant. Their characteristic inch auger holes and gopher-like mounds were found mainly along the edges of sandy fields, but also frequently in the middle of corn and cotton fields that had been thoroughly cultivated. Some of the mounds were 6 inches high and contained 6 or 8 quarts of earth, and were distinguished from gopher hills only by being solitary instead of in a series. By opening the burrow under these mounds I could catch the occupant at any time of day, but most of my specimens were *caught at night* in traps set at the open doorways or in artificial run-scraped with my foot along the ground near by. Sorghum proved the most attractive of the several kinds of bait tried.

Seel, the market gardener with whom I stayed, complained of trouble in raising cantaloupes and green peas, because some dug up the seeds as fast as he could plant them. In the midst antaloupe patch, where only four or five plants had survived, d traces of these mice and caught two of the animals. A few lived around the edge of the field, but a few nights' trapping have cleared them all out and no doubt would have prevented r trouble.

others of the genus, these mice are mainly nocturnal and are seen alive. The little that is known of their habits has been ed by trapping them for specimens. At times they are read ught in traps baited with rolled oats or various grains, and they obstinately refuse to touch any kind of bait or to come the traps. When caught they often have their cheek pockets full of the trap bait or of wild seeds.

y are active all winter and apparently never become very fat w signs of hibernating.

nathus hispidus paradoxus Merriam. Kansas Pocket Mouse.

s **large**, pale subspecies of the *Perognathus hispidus* group s over the open plains and desert country from South Dakota zona, including northern and western Texas, south to Presidio y and Comstock and east to Rock Springs, Colorado, Mobeetie, ipscomb, mainly in Upper Sonoran zone. From the smaller rker-colored *hispidus* on the south and from *spilotes* on the [illegible] ding off is so gradual that no sharp line can be drawn between nges. Immature specimens from Brazos, Henrietta, and [illegible] t be positively referred to one rather than another of the three s, and the Lipscomb specimen leans toward *spilotes*.

habits of *paradoxus* do not differ from those of other forms of oup except as they have been modified to meet the conditions ins and desert. In the Guadalupe Mountains I caught one in ad of Dog Canyon at 6,500 feet altitude, [illegible] below the edge nsition zone, and at Amarillo, on the top of the Staked Plains, ght one and found part of the [illegible] urrowing owl's nest [illegible] s, in the Pecos Valley, but [illegible] rande. Loring took one at H[illegible] kenridge, and Oberholser [illegible] rfa Oberholser caught one [illegible]

At Brazos Cary caught one [illegible] in its pockets in a field of [illegible] madio County had its pockets full of [illegible] another at Smithville, S. Dak., in June had its pockets full of *Cymopterus* seeds. In the Castle Mountains Cary took one from the stomach of a rattlesnake, and near Texline Howell also found one in one of these snakes.

Perognathus hispidus spilotus Merriam. Black-eared Pocket Mouse.

A specimen collected by Hollister at Jefferson not only extends the range of this group of pocket mice eastward almost across the State, but exhibits in an accentuated degree the characters of *spilotus*, described from Gainesville specimens. This record, with a few others, gives an extensive and logical range to what seems to be a fairly well-marked subspecies, which differs from typical *hispidus* in slightly darker and richer coloration, with more of a tendency to suffusion of yellow over the belly and along the top of the foot and the under surface of the tail, in larger and blacker spot on upper edge of ear, and in the extension of the nasals back to or beyond the posterior tips of premaxillæ. Besides the Gainesville and Jefferson specimens, I should refer to the subspecies a richly colored flat skin from Long Point in the National Museum collection, a good skull from Saginaw, a few specimens from Ponca and Orlando, Okla., Red Fork, Ind. T., and an immature specimen from Garden Plain, Kans.

At Gainesville I caught two specimens on the edge of a pasture in rather tall prairie grass, but they, as well as all other rodents were scarce on the black, hard soil of that region. At Jefferson they were fairly common, and Mr. Richard Crain told me that he often plowed them out, and that his cat frequently brought them to the house. I found a number of their characteristic burrows with fresh tracks around them, but could not coax the animals into my traps with any kind of bait. Hollister caught one in a trap set in a path running between a cotton field and the woods, but at Antioch he could not catch them, although the farmers there described the species accurately and said that at times they were common. One of the Gainesville specimens had seeds of a little Mimosa in its pockets, and another at Ponca had its pockets full of *Petalostemon* seeds

Perognathus penicillatus eremicus Mearns. Desert Brush-tailed Pocket Mouse.

This desert pocket mouse inhabits the Lower Sonoran zone of extreme western Texas, ranging from El Pasò east to Monahans south to Boquillas, and westward into Mexico. There are Texas specimens from El Paso, Boquillas, east base of Chisos Mountains, 35 miles south of Marathon, Toyahvale, Pecos City, and Monahans.

At El Paso, in 1889, I caught this soft-haired species in the sandy bottoms below town and supposed that it had a different range from the spiny-rumped *intermedius* caught at the same time in the rocks above town; but later Doctor Fisher caught one on the gravelly mesa near El Paso. Cary caught one among the mesquites at Pecos City, and a number among the mesquites on a hard, limy ridge at Monahans. In the Boquillas and Great Bend region Oberholser and I found the species associated with *nelsoni* on sandy bottoms and among rocks of the cliffs bordering the Rio Grande, and around old stone cabins. While they are evidently partial to valley bottoms, the one essential for their burrows is a bit of mellow soil which may be found among broken bowlders or between thin strata of limestone, as well as on the sandy flats, or in the soft mesa soil that collects around the base of desert bushes. The little mounds that usually cover the entrances of their closed burrows are easily distinguishable from the work of any other species of the region except *intermedius* or *nelsoni*. They are often elongated or fan shaped, and stretch away to a distance of a foot or so from the point where the earth was brought up, as if pushed or kicked out, much like the mound or strip of dirt thrown out in front of the burrows of the smaller species of *Dipodomys*. The entrance of the burrow is usually but lightly closed and can be easily broken into with the finger. By breaking the crust above it the burrow may be followed for a considerable distance where it runs near the surface. As usual with pocket mice and kangaroo rats, there are several openings and radiating tunnels from the central cavities of the subterranean den, and while part of these are closed, there are generally concealed openings or some means of ready escape.

These mice, like the whole family, are mainly nocturnal, but can be caught in the daytime by opening a closed burrow and setting a trap inside, sometimes in a very short time after placing the trap. Usually they take rolled oats readily, and are easily caught in traps set around their burrows or in long furrows drawn in the sand, which they almost invariably follow till a trap is reached. When caught their cheek pockets are often full of rolled oats from the trap bait, or partly filled with seeds of various plants.

Perognathus intermedius Merriam. Intermediate Pocket Mouse.

A large series of specimens from the El Paso region are almost typical *intermedius*. From *eremicus*, with which these pocket mice are associated, they are easily distinguished by the spinescent hairs of the rump and apparently by a difference of habitat. At El Paso, in 1889, I caught them only in the rocks in the foothills of the Franklin Mountains, and *eremicus* only on the sandy flats below town. In 1903 Gaut collected them in the eastern foothills of the Franklin Mountains up to 4,800 feet, and reported them as living around the rock slides and cliffs. While in other localities *eremicus* also has been taken among rocks, *intermedius* throughout its range is closely associated with cliffs, canyons, rocky gulches, stone walls, or the edges of bowlders.

Perognathus nelsoni Merriam. Nelson Pocket Mouse.

Specimens of this dark-colored form of brush-tailed pocket mouse from Boquillas, east base of Chisos Mountains, Alpine, and east base of Davis Mountains, carry the range of *nelsoni* from Mexico well into western Texas, where it overlaps the range of the superficially similar but quite distinct *eremicus*. At Boquillas and the east base of the Chisos Mountains, Oberholser and I caught the two species together along the cliffs, on sandy flats, and about old stone cabins. While the freshly caught animals were readily distinguished by the spinescent rump and dusky soles of *nelsoni*, no constant difference was found in habits or habitat of the two species. Near Alpine Lloyd caught one specimen at the base of a cliff; and at the east base of the Davis Mountains, at approximately 5,000 feet, Cary caught one under a pile of rocks.

Perognathus nelsoni canescens Merriam. Gray Brush-tailed Pocket Mouse.

The gray pocket mouse is represented from Texas by 5 specimens from Comstock, 4 from Langtry, and 1 from Sheffield. Except for the slightly larger and more angular interparietal, they seem to be typical *canescens*, which was previously known only from the type locality, Jaral, Coahuila, Mexico.

Hollister caught one among the rocks in a small canyon near Comstock, several others along the edge of the Rio Grande Canyon a few miles south of there, and still another on a steep rocky slope near Sheffield; Gaut caught four in the vicinity of Langtry in small caves among the rocks of the river canyons.

Nothing is known of the habits of this pocket mouse save what can be gathered from the character of its habitat, an extremely hot and barren region with light-colored soil and gray limestone cliffs.

Perognathus flavus Baird. Baird Pocket Mouse.

In Texas the Baird pocket mouse is common at El Paso, Sierra Blanca, Valentine, Alpine; and probably in the Pecos Valley, and in the northwest corner of the Panhandle, since it occurs just beyond the Texas line at Carlsbad (Eddy), N. Mex., and at Beaver River, Okla.

At El Paso these little yellow pocket mice were common in December, 1889, along the edges of the sandy valley bottom 2 miles below town, where little sand drifts were heaped up around the base of *Atriplex* and *Suaeda* bushes. Their burrows were usually in groups of three or four, under the edges of the bushes. The occupied ones were closed, and were discovered only by following the lines of tiny tprints across the bare patches of sand from bush to bush till hey disappeared at little mounds of fresh earth that served as doors nd blinds to the underground houses. By scraping away the earth burrow big enough to admit my little finger was disclosed under ach tiny mound. Traps baited with rolled oats set near the burows and along the lines of tracks soon yielded a series of 8 specinens in the rich satiny winter coats—the daintiest, most exquisite f the rodents commonly classed as 'mice.' On chilly nights they id not move about much, but on mornings following a warm night heir lines of tracks were abundant, and radiated from the burrows o the nearest patches of wild sunflower and pigweed, whose seeds eemed to furnish their favorite food. One specimen caught Decemer 15 was apparently nursing young, or lately had been, as the teats ontained milk.

At Valentine in August, 1902, I turned over a flat stone in the hotel yard and caught one of these little pocket mice as he jumped out of his burrow, and at Sierra Blanca in December, 1889, caught one at a hole in the mellow soil of the railroad bank. At Alpine Gaut caught one in an old gopher mound about 3 miles east of town.

erognathus merriami Allen. Merriam Pocket Mouse.

This little dusky and yellow pocket mouse ranges over southern Texas from Padre Island and Brownsville north to Devils River, Austin, Mason, and southward into Mexico. Specimens from Devils River and Comstock are fairly intermediate between *merriami* and *gilvus*, as apparently are two specimens from Washburn, which would indicate that *merriami* ranges well up along the east side of the Staked Plains.

The species is common on sandy or mellow soil, more often among weeds and brush than in the open. Their little mounds of earth thrown out on two or three sides of a cactus, bunch of bushes, or flat rock mark the main entrances to their dens. These doorways are always closed during the day if the den is occupied, and when opened from without are usually promptly closed again from within. A careful search near the mounds will generally disclose several little round holes standing open, with no trace of earth thrown out, but with the openings often concealed under bushes or leaves. If you dig into the main burrow or stamp on the ground, a *Perognathus* will often dart out of one of these openings, or more often break through a thin crust of earth that covered a concealed exit and after a leap or two will sit trembling and blinking in the dazzling light of day. It is then so easily caught in the hands that many of our specimens are secured in this way. Most of these are young of the year, however, as apparently the adults are not so readily driven from their dens. When caught they do not offer to bite, but sometimes utter a fine squeak, and if held gently for a while soon cease struggling and seem to lose all fear. The light evidently hurts their eyes, and after blinking for a while they soon close them if held quietly in the hands or placed in an undisturbed position on the ground. While often abundant, these little mice are not easily caught in traps, and usually seem indifferent to any bait we use, frequently pushing the traps out of the way or turning them over when set near their burrows or in places where they run. Sometimes they can be caught by placing the trap where they have to step in it in going out of or into their burrows. Near Kerrville a number were caught in this way, while only one out of five had filled his pockets with the rolled oats used for trap bait. A couple were caught in traps baited with juniper berries, which seemed to be a favorite food. In a number of burrows I found juniper seeds or the empty shells from which the kernel had been eaten out through a little hole in one end. In some cases these berries must have been brought from a distance of 10 or 20 rods. In one den under a flat rock, where three tunnels, a foot to a foot and a half long, met in a nest chamber the size of my fist, there was a handful of fresh juniper seeds carefully cleaned of the outer pulp. As this was in May, and the occupant of the burrow was not a full-grown animal, this store was probably laid up for a rainy day rather than for a winter supply. At another burrow a lot of old moldy corn and bits of rubbish mixed with fresh earth were brought out, a little each night, as if in a general house cleaning, indicating that various seeds and grains are stored up in times of abundance. As the mice do not hibernate and as seeds of one kind or another are usually abundant, there is no need of laying up large stores of food.

Perognathus merriami gilvus Osgood. Dutcher Pocket Mouse.

The Dutcher pocket mouse inhabits the Pecos Valley from Carlsbad (Eddy), N. Mex., south to Langtry and the Painted Caves, eastward to Big Springs, and 20 miles east of Rock Springs, and westward to Van Horn and Presidio County; in other words its range coincides approximately with that of the creosote bush in all but the western corner of the extremely arid Lower Sonoran zone of western Texas. It overlaps the range of *flavus*, occurring with it at Carlsbad, and apparently overlaps also the range of *copei* in the country north of Monahans, from both of which it is quite distinct and easily distinguished. From *merriami*, of which it is a larger, lighter yellow subspecies, it shades off along the southern edge of the open and extremely arid region. Specimens from near Rock Springs, along Devils River, and near the mouth of the Pecos are more or less intermediate between the two forms.

In habits these pocket mice do not differ from *merriami* except in as they have become adapted to a more open and arid region.

gtry Oberholser found them common on the stony mesa, and Lancaster in the chaparral of the bottom of the Pecos Valley. [illegible] Cary reported them as abundant in September about the sand dunes and as feeding extensively on the seeds [illegible] shrubby *Baccharis*. In the dry and barren valley 6 miles [illegible] Marathon I caught them in the baked soil among the [illegible] bushes and cactus, and 10 miles farther south [illegible] common in the still more arid and stony valley [illegible] Creek. Their characteristic little burrows were found [illegible] of stones, under bushes and cactus, and occasionally [illegible] of bare ground, but the occupants refused to enter my [illegible] bait. A few were dug out of their burrows and [illegible], and from these Mr. Fuertes was able to make [illegible] lifelike studies. When first caught the little fellows [illegible] frightened and struggled to escape, but never offered to [illegible] teeth. After being held gently for a few minutes they [illegible] forget their fear and would sit quietly on the open hand [illegible] at a time, blinking sleepily in the unfamiliar glare of [illegible] At a sudden motion they would bound away in long leaps, [illegible] stop under a weed or bush. While sitting motionless with [illegible] they could be easily recaptured by approaching [illegible] and covering them quickly with the open hand.

athus flavescens copei Rhoads. Cope Pocket Mouse.

[illegible] specimens taken by Gaut in July, 1901, at Mobeetie, the [illegible] of *copei*, possess characters which enable this form to [illegible] bright-colored subspecies of *flavescens*. [illegible] taken by Cary in the sand hill [illegible] south of [illegible] accentuated characters [illegible] northern range. They suggest [illegible] corner of New Mexico [illegible]

[illegible] Mobeetie specimens, 1 adult female [illegible] were caught at a den on the edge of a millet field [illegible] entrances of two burrows [illegible] grew. The millet in the field [illegible] of the animals had [illegible] of traps yielded [illegible] animal were found [illegible] this locality. The failure [illegible] topotypes of the [illegible] of the rattlesnake from the [illegible] which the type [illegible] Professor Cope [illegible] Proc. Acad. Nat. Sci. Phila. [illegible]

Perodipus ordi (Woodhouse). Ord Kangaroo Rat.

This little five-toed kangaroo rat is common in the Rio Grande Valley at El Paso and Fort Hancock, and a few specimens have been taken in a tributary valley of the Rio Grande at points 6 to 20 miles south of Marathon. A specimen from Kent, one from Toyahvale, and an imperfect one from Pecos seem to be almost typical *ordi*, while the larger, brighter-colored *richardsoni* is almost typical at Monahans, only 37 miles east of Pecos. The specimens at hand do not clearly prove intergradation in this region and the two forms have well-defined ranges which conform closely to Upper and Lower Sonoran zone limits.

Perodipus ordi is one of the few Lower Sonoran species of this mainly Upper Sonoran genus. In the extremely hot and arid valleys of western Texas it ranges over much of the same ground as *Dipodomys ambiguus*, which it closely resembles in habits as well as appearance. At El Paso I caught specimens on the sandy flats below the town under brush and cactus on the same ground and even at the same holes with *Dipodomys ambiguus*. At Deming, N. Mex., they were common in the sandy strips along the dry valley of the Rio Mimbres, where, in patches of scattered brush and weeds, they were feeding on seeds of wild sunflowers, *Parosela*, and other wild beans. Of ten adult females caught November 29 to December 6, four were giving milk. At the same time numbers of nearly full-grown young were caught, which would indicate either that two litters of young are raised in a season or that the breeding season is very irregular.

Perodipus montanus richardsoni (Allen). Richardson Kangaroo Rat.

This largest and brightest colored of the four species of five-toed kangaroo rats inhabiting Texas comes into the State from the Upper Sonoran plains to the north, but instead of keeping to the hard-soiled, Upper Sonoran part of the Staked Plains it completely encircles them. It lives in the sandy stream valleys in the upper edge of the Lower Sonoran zone, but nowhere extends far enough down to be out of reach of Upper Sonoran plants. There are specimens in the Biological Survey collection from Texline, Lipscomb, Tascosa, Canadian, Mobeetie, Newlin, Vernon, Colorado, Stanton, and Monahans in Texas, and from Carlsbad, Roswell, Fort Sumner, and Santa Rosa, in the Pecos Valley, New Mexico. At Carlsbad and Monahans it meets the range of and occupies the same ground with *Dipodomys merriami*.

Throughout its range this species shows a marked partiality for sand, and from Nebraska to Texas fairly revels in the mellow soil of the yellow, shifting, naked drifts and dunes that the wind piles up along the edges of most of the river valleys. It digs an apparently essary number of burrows, which it abandons to other less ener- rodents or uses only as convenient resorts in case of sudden ger. It scampers over the smooth surface with the apparent ment of rabbits on a crusted snow or boys on a skating pond. [illegible] tracks of the long hind feet are found in the morning in ag [illegible] over the drifts, sometimes registering hops of a few es again, flying leaps of 4 to 6 feet, only to be wiped out each [illegible] drifting sand and re-registered each night in varying form. gh the weeds and grass of a sandy prairie or the standing grain [illegible] stubble of a wheat field the kangaroo rats make little [illegible] from burrow to burrow or radiating from burrows to the g grounds, and always keep a clear track for retreat to doors [illegible] are left wide open day and night. Many of the burrows gle, but generally the home den has several openings, with leading away from each. For the size of the animal the bur- are large, and in a mound or slope they go back horizontally, at in case of a hard rain the water runs out of instead of into Even on level ground the holes enter as nearly horizontally ble, and sometimes run along for 10 or 15 feet without going a foot below the surface. If no sand bank offers the proper the burrow is usually placed under a bunch of cactus, a clump [illegible] bushes, or under some shrub that affords protection as as a slight eminence to burrow into.

food of this, as of other species of the genus, is almost entirely [illegible] including those of many grasses, various native plants, and [illegible] small grains. These seeds are neatly shelled out and eaten [illegible] carried in the ample cheek pockets to the dens to be [illegible]. No matter how [illegible] the seed the shell [illegible] the contents of the [illegible] of the [illegible] are always clean and free from [illegible] of the burrow [illegible] several dens examined I [illegible] generally a little ripe grain [illegible] or other grain is dug up [illegible] numerous than usual [illegible] for serious consideration.

dipus sennetti (Allen). [illegible]

[illegible] type of *P*[illegible]

[illegible] County, Tex. [illegible]

topotypes have not [illegible]

Rio Colorado, 35 miles [illegible]

ng just where he [illegible] type of *P*[illegible] Mr.

[illegible] writes under date of [illegible] that it was taken at

Santa Rosa stage station, 85 miles southwest of Corpus Christi. This is on the Alice and Brownsville stage road, near the northwest corner of Cameron County, 115 miles from Brownsville. From this point north to Santa Rosa, across 60 miles of mainly sandy prairie, the species is abundant, and a series of specimens from Sauz Ranch and Santa Rosa shows no variation in characters. A specimen recorded by Mr. Oldfield Thomas[a] from San Diego is shown by the skull measurements to be of this species, but whether collected by Mr. Taylor at San Diego or from the sandy country farther south is not stated. Oberholser found no trace of any kangaroo rat at San Diego. Mr. H. P. Attwater collected 5 specimens 18 miles south of San Antonio. Through the kindness of Dr. J. A. Allen I have examined two of these specimens, now in the American Museum of Natural History, and agree with him that they are typical *sennetti*. Mr. Attwater reported a female taken August 23, containing "two small embryos," and says: "These beautiful little animals appear to be quite common in the sandy black-oak region south of the Medina River in Bexar County. Their burrows seem to be most numerous in the poorest, sandy soil."[b]

Along the Alice and Brownsville stage road the burrows of the Sennett kangaroo rat are common in the yellow sand, sometimes remaining open during the day and sometimes being securely closed with earth. William Lloyd, who camped in this region, says:

> In the deep sand around the stage stations they soon learn what corn and oats are and become great robbers. They seem to enjoy the moonlight nights, skipping about, and on several occasions coming close up to my bed. A motion and they are ten steps away, crouched against the sand; then, if not noticed, they rise and continue their rambles. A lighted lantern seems to puzzle them, and leaving one on the ground to attract them I have caught two of the animals in my hands. At Santa Rosa, while out with the lantern, I saw one starting a burrow. It tried two or three places, presumably to find one sufficiently soft, and at last, apparently suited, pushed its nose in, and drawing its hind feet up close to its jaws, scratched vigorously and soon had made a good beginning to a burrow, when I caught it in my hands.

Perodipus compactus (True). Padre Island Kangaroo Rat.

While closely resembling *sennetti* in cranial characters, *compactus*, even in its darkest color phase, differs from all the mainland forms of Texas in its light coloration, white-margined ears, usually white soles of feet, and mainly white under surface of tail. In the light phase it is unique in having the upper parts a pale ashy gray. In a series of 23 specimens there are 9 of the dark phase and 14 of the light, caught on the same ground by William Lloyd, who said that while he found no difference in their habits he could tell them apart even by moonlight.

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[a] Proc. Zool. Soc. London, 1888, p. 446.

[b] Allen, Mammals of Bexar County, Tex., Bul. Am. Mus. Nat. Hist., VIII, 56 1896.

These kangaroo rats are probably common over the whole length of the 100-mile sand reef known as Padre Island, as Lloyd found them at both the north and south ends. He reported them as sometimes found in the level soil; but usually living in the sand dunes and always on the side away from the prevailing wind. He says:

> At the north end of the island, where most abundant, they close their burrows before daylight, throwing out several quarts of sand in a little mound like a small gopher hill and opening them again after dark. Their object in thus closing their doors is not very evident, as snakes and crabs are too few to bother them. I believe it must be to keep out the black carrion beetles that occupy every disused hole, and a species of pale sand grasshopper that lives in similar situations. Traps set in their burrows were usually covered up with sand, and most of the specimens were caught in the runways, where the prints of their two hind feet and the swish of their tails made unmistakable signs. They feed on the seed of a small sand plant like purslane, and take oatmeal readily as trap bait. After a violent storm their bodies are common objects among the wreckage along the shore, attracting the attention of the boatmen, who call them white rats.

Dipodomys spectabilis Merriam. Large Kangaroo Rat.[a]

This beautiful, big kangaroo rat is common in the upper edge of the arid Lower Sonoran zone of extreme western Texas, east to the eastern edge of the Pecos Valley at Monahans and Odessa, and north and south along the Pecos Valley from Adams, Tex., to Santa Rosa, N. Mex. It apparently does not inhabit the lower half of the zone, as it extends neither into the Rio Grande Valley of Texas nor the Gila Valley of Arizona. I have not found it nearer to El Paso or the Rio Grande than Sierra Blanca, Tex., and Jarilla, N. Mex., on the east, and Deming, N. Mex., on the west. While ranging to the extreme upper edge of the zone, it does not enter Upper Sonoran to any extent. In Texas it is common at Sierra Blanca, Van Horn, Valentine, Kent, Toyah, Toyahvale, Adams, Pecos, Grand Falls, Castle Mountains (west base), Monahans, and Odessa; and Gaut collected one specimen at the east base of the Franklin Mountains, 10 miles north of El Paso.

Although strictly nocturnal animals and rarely seen alive, these kangaroo rats usually make their presence evident by conspicuous mounds scattered here and there over the barest and hardest of gravelly mesas, mounds as characteristic and unmistakable as muskrat houses or beaver dams, and as carefully planned and built for as definite a purpose—home and shelter. An old mound that has been inhabited for years is often 3 or 4 feet high and 10 or 12 feet wide, a dome-shaped pile of earth entered from the top and sides by a half dozen, or sometimes a dozen, big burrows that would easily accommodate a cottontail rabbit. Well-beaten paths lead away from each of these doorways to others or to neighboring mounds. Usually one or more of the doorways are closed each morning with earth behind the retiring inmates, probably to keep out rattlesnakes and other unwelcome guests. At night these earth doors are opened for use, and the best place to set a trap for the animal is in front of a closed, rather than an open, door. While all of the holes are used more or less at night, apparently only the closed ones are occupied in the daytime. All the fresh earth brought out of the burrows and much that is dug up outside is scraped back on to the mound, so that its size slowly increases with age. Inside, the burrows widen out into roomy chambers, some of which are close to the surface, while others are deep and at the ends or sides of winding burrows. In trying to walk over these mounds one is almost sure to break through knee deep into the chamber below.

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[a] It is to be regretted that the name 'kangaroo rat' has become firmly fixed on this group of beautiful Jerboa-like rodents, which are as unratlike as they are widely removed from the Marsupials.

While the kangaroo rats do not hibernate or store up great quantities of food, they carry considerable food into the burrows to be eaten probably during the day, as shown by deposits in their chambers, by the shells of seeds and grain brought outside during house cleaning or found scattered over their chamber floors, and by the presence of seeds in the fur-lined cheek pouches of individuals caught in traps. That the inmates of these mounds are not always asleep during the daytime can be proved by tapping or scratching at the entrance of the burrow and then listening for a response. A low drumming sound can usually be heard from deep underground, sometimes from two or three points. Apparently it is made as the similar drumming of the wood rats is known to be, by beating the soles of the hind feet rapidly on the ground, which produces a tiny, vibrating roar, and is used as a signal of alarm, call note, or challenge. The animals are social. Often three or four are caught in a mound, and the trails lead from one mound to another. The paired prints of the two long hind feet are fresh every morning in the trails and dusty roads, but I have never seen a print of the tiny hands which apparently are never used in locomotion. When caught in traps or in the hands, the animals struggle violently, but never make a sound or offer to bite. Like rabbits, they are gentle and timid and depend on flight and upon their burrows for protection.

Dipodomys elator Merriam. Loring Kangaroo Rat.

Specimens of these kangaroo rats are known only from near Henrietta and a point 10 miles to the southwest, and from Chattanooga, *Okla.* Oberholser says:

> They are not common in the immediate vicinity of Henrietta, but seem to be at occurrence from 20 to 30 miles to the southwest and most abun

tant between 2 and 13 miles in this direction. The approximate limits of their range are from Henrietta about 4 miles north, 5 miles east, 22 miles south, 8 miles west, and about 43 miles southwest. They live, so far as determined, almost exclusively among the mesquites and make their holes around the roots of the mesquites and bunches of *Opuntia*. One of the specimens caught was found in the throat of a large rattlesnake that had swallowed it as far as the trap would permit.

Loring, who first caught these kangaroo rats at Henrietta, says:

> At one set of holes the main entrance was closed every morning with dirt from the inside, and my traps were not touched. The hole was so small that I thought it might be a *Perognathus*, so got a pick and shovel and dug it out. The burrow branched from below and opened out at four different points. One of the rats was caught in a muddy pocket the size of my fist at the end of the main burrow, the other was covered with dirt in a sharp bend of the burrow, but escaped into another hole near by. The deepest and longest burrow ran about 3 feet underground. I did not find any grass or seeds in any of the burrows. Taking the rat that I had caught to a large field, I turned it loose. It sat for a minute, dazed by the sun, but when I poked it scampered off at such a lively rate that I could hardly keep up and could not see whether it used its fore feet or not. It was very quick and graceful. While jumping its tail was slightly curved up and was not used in any way to aid in its progress.

Near Chattanooga, Okla., some 50 miles northwest of Henrietta, Tex., Prof. D. E. Lantz collected a specimen and reported on the species as follows:

> While not numerous, they seem to be well distributed in the vicinity of Chattanooga. Nearly all of the settlers with whom I talked were acquainted with them and informed me that they lived about the premises of their homes. Several were confident that they could capture one or more specimens for me, but only one was secured. This was killed by a farmer as he was walking across the prairie on a dark night with a lantern. It had been foraging in a Kafir corn field, and I found its pouches widely distended with grain. They contained 100 seeds of Kafir corn and 65 seeds of *Solanum rostratum*. In the vicinity of Chattanooga the animals are found on hard clay soils, and they seem to prefer the vicinity of houses, living under houses and outbuildings and in caves made for storing vegetables and other household supplies. They seem to be attracted by lanterns or other lights carried on dark nights.
>
> Mr. Laurie, living in Chattanooga, has a cave back of his hardware store in which a pair of kangaroo rats had taken up their winter quarters. He purchased a couple of bushels of wheat to feed to his poultry and placed it in the cave. Some time later, when he wished to begin to use it, he found that it had all disappeared. Last spring he removed some boards which lined the lower part of the cave on the inside and found all of the wheat carefully stored away behind the boards by the kangaroo rats.

Dipodomys merriami Mearns. Merriam Kangaroo Rat.

This little dull-colored kangaroo rat of the four-toed group ranges over most of the extremely arid Lower Sonoran zone of western Texas, except where it gives place to *ambiguus* in the immediate valley of the Rio Grande. Specimens from near Langtry and 6 miles south of Marathon, Fort Stockton, Toyahvale, Pecos, Monahans, Kent, and Sierra Blanca, Tex., and from Carlsbad and Tularosa, N. Mex., are almost typical *merriami*, differing slightly in duller and darker coloration, the opposite extreme from *ambiguus*. The cranial characters throughout the group are extremely uniform.

The habitat of this species is mainly dry, half-barren mesas or open desert valleys, where the animals make their homes in baked and stony soil or less frequently in sandy patches. At Monahans Cary found them only on the hard soil of the valley and never among the sand dunes with *Perodipus richardsoni*, though at Marathon, Kent, Stockton, and Sierra Blanca they were caught in the same ground with *Perodipus ordi*. Except in choice of higher, rougher ground they seem not to differ in habits from *ambiguus*.

Dipodomys merriami ambiguus Merriam. El Paso Kangaroo Rat.

This little four-toed kangaroo rat, differing from *merriami* in its brighter, more golden color, seems to be of very local distribution along the sandy bottom of the Rio Grande Valley from El Paso and Juarez south to Boquillas in the Great Bend country. A series of specimens from Sierra Blanca is intermediate and can be referred in part to this and in part to *merriami*.

In the Rio Grande Valley it does not differ much in range or habits from *Perodipus ordi*, which it resembles so closely externally that specimens can not be safely named without reference to the toes on the hind feet. In the flesh the two can be distinguished at a glance by the much slenderer feet and tail of the *Dipodomys*. On the sandy river bottoms just below El Paso, where I caught many specimens of the two genera on the same ground and sometimes at the same burrow, I could find no difference in habits or local habitat.

Their little burrows usually are under a bunch of mesquite, acacia, or creosote bushes or cactus, evidently for the sake of protection from enemies, or in order to get a little shade from the fierce heat of the sun's rays. Often their burrows enter from several sides of the bunch of bushes or cactus, and converge toward a common center, where they apparently meet below. Some of their doorways are usually closed during the day, while others are left open. Like all the genus, they are strictly nocturnal and at night feed on the ripe seeds of various plants or carry them into the burrows to be eaten at leisure. Often when caught in traps their cheek pouches are stuffed with seeds or with the rolled oats used for trap bait. Occasionally a bit of green leaf is found in the pockets, but I have seen only the fine white pulp of ripe seeds in their stomachs—no green foliage or anything that would seem to furnish moisture.

Erethizon (epixanthum?) Brandt. Yellow-haired Porcupine.

The only specimen of porcupine I have seen from Texas was a *dly stuffed* skin and a fragment of skull brought me at Tascosa in

1899 by a ranchman who had killed the animal there the previous year. At Alpine in 1900 the ranchmen told me that porcupines were occasionally found there, and in the Davis Mountains in 1901 I found a bushel of their unmistakable signs in a cavity under the rocks, where a porcupine had evidently lived for a good part of the previous winter. As the Finleys, who have lived for many years in the Davis Mountains, had never seen nor heard of these animals, they are evidently not common there.

Lepus merriami Mearns. Black-naped Jack Rabbit.

The black-naped jack rabbits are common over southern Texas, from Brownsville north to the mouth of the Devils River, Fort Clark, and San Antonio, and east to Cuero, Port Lavaca, and Matagorda. They occur with *texianus* in the eastern part of their range and meet or overlap its range in the Devils River country.

In April, 1900, I found them common all the way from Corpus Christi to Brownsville, both on the prairies and in the mesquite and chaparral; and in April of the previous year, between Victoria and Port Lavaca, I counted from the train six that were so close that the black necks showed conspicuously and served to distinguish them from *texianus*, which also was seen along the road. In February, 1894, Loring reported them as common from Alice to Brownsville, as many as ten being seen in a bunch. In March, 1900, Oberholser reported them as numerous on the Thomas ranch, near Port Lavaca, inhabiting chiefly the open prairie, where they found cover under tall bunches of grass. In April and May of the same year he reported them at O'Connorport as only fairly common and very wild; at Beeville as common, living principally on the prairie and in the more open areas in the chaparral; in the immediate vicinity of town as very wild, but farther away, where not often hunted, as much less so; at San Diego as abundant in the more open portions of the chaparral; at Laredo as abundant all through the chaparral; at Cotulla as abundant in the chaparral and very tame, apparently living in the thick brush, although late in the afternoon frequenting the more open, grassy places, where sometimes as many as six or eight were seen together; at Uvalde as abundant and very tame, inhabiting the more open parts of the chaparral, particularly the area between town and the base of the hills to the northward; and at Rock Springs as common on some of the more open areas. On May 29 and 30, 1903, Gaut collected an old male and a 2-weeks-old young one near Del Rio, where he found jack rabbits scarce, although they were said to have been very numerous a short time previous. Only one other individual was seen in three weeks, although considerable time was devoted to hunting for them. Lloyd reported them, in 1891, as common on Padre Island and as generally found crouched in the short grass on the open sand.

Over most of their range the black-naped jack rabbits are sufficiently numerous to do considerable damage on farms and truck gardens, as they are fond of many cultivated plants. At Laredo, in April, Oberholser reported that a field of cantaloupes with vines 6 inches high was entirely ruined by them, and a similar field of watermelons was extensively damaged. As raising early vegetables and fruits has become an important industry in southern Texas, the abundance of the rabbits is a serious matter. Their consumption of range grasses in a region that is mainly devoted to stock raising is also a matter of considerable importance.

In general characters this species does not differ much from *texianus*, but in life the difference appears much greater than when specimens are compared. As the rabbit sits up at a distance or, with ears erect, runs across the prairie, the black nape contrasts sharply with the snowy white backs of the ears, and the black tail and rump stripe with the almost white hams and flanks. Near Cuero one jumped from beneath a low mesquite bush close to me and, after a few long leaps that were like flashlights of black and white, suddenly stopped and crouched, lowering the dull gray ears until their white surface rested on and wholly concealed the black neck; the tail was curled up till its black upper surface concealed the black rump stripe and left only the gray lower sides exposed, while at the same time the white hams and flanks close to the ground served to cut out shadow and obliterate form, so that the whole animal was transformed into a part of the great prairie.

This same rabbit, now made into a specimen, does not seem very different from *texianus*, except when the ears are raised to show the black neck; but alive and running, its specific characters might have been recognized at a distance of 40 rods.

Lepus texianus Waterhouse.[a] Texas Jack Rabbit.

Lepus texianus griseus Mearns, Proc. U. S. Nat. Mus., XVIII, p. 562, 1896. Type from Fort Hancock, Tex.

The jack rabbits, except from extreme northern and southern Texas, can be referred to this form with gray or whitish nape and

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[a] I find no grounds whatever for following Doctor Mearns (Bul. Am. Mus. Nat. Hist., II, p. 296, 1890) and Doctor Allen (Bul. Am. Mus. Nat. Hist., VI, p. 347, 1894) in restricting the name *texianus* to the Arizona jack rabbit. In Waterhouse's original description (Natural History of the Mammalia, II, p. 136, 1848) the only real characters mentioned which distinguish the Texas and the Arizona forms are in the fifth and sixth lines of the description on page 136, "throat and abdomen white; haunches and outer surface of legs gray; tarsus nearly white"—all of which applies to the Texas animal rather than to the Arizona form. The measurements, while evidently from a mounted specimen and of no real value, indicate the slightly smaller size of the Texas form.

[illegible] flanks. They are common over the arid plains country of [illegible] western Texas, south to Rock Springs and San Antonio, [illegible] and Brazos westward to Langtry and El Paso; and [illegible] the strips or islands of prairie country eastward [illegible] the State. A specimen collected by Hollister at [illegible] County, is nearly typical *texianus*. A few jack [illegible] of the same species, are reported by Oberholser from [illegible] Boston, in the northeastern corner of the State, and [illegible] prairie west of Beaumont. From residents of [illegible] I have obtained reports of a few from Calcasieu Parish, [illegible] corner of Louisiana, and from the Texas prairie [illegible] and Richmond; and on the prairie near Houston, [illegible] Lavaca have myself seen the rabbits close enough to [illegible] were not *merriami*. Specimens from San Antonio, [illegible] Colorado City show a tendency toward *melanotis*, [illegible] from Vernon and Henrietta can be referred to that sub[illegible] those of the Panhandle country. In the Davis [illegible] the jack rabbits ascend to the edge of the yellow pines, or [illegible] through Upper Sonoran zone, where I have found them [illegible] July and January. In the Guadalupe Mountains [illegible] August up to 7,000 feet on the open ridges [illegible] range in Texas lies in Lower Sonoran zone [illegible] they are most abundant.

[illegible] of the jack rabbits varies [illegible] different [illegible] to have a wave-like [illegible]. After [illegible] extremely numerous, they [illegible] appear rather [illegible] scarce for a few years [illegible] periodic change does not [illegible] however, for at the [illegible] valley and [illegible] from Marfa [illegible] a moment when [illegible] road or [illegible] as many as 20 [illegible] of the [illegible] Pecos and Del Rio [illegible] May, [illegible] dozen [illegible] were [illegible] the [illegible] wagon road from [illegible] to Grail and [illegible] they were numerous, and in places where no rain had fallen that year and the vegetation was scant and dried up the jack rabbits had seconded the prairie dogs in eating the bark from the small mesquite bushes, from *Opuntia arborescens*, and a large part of the fleshy pads of *Opuntia engelmanni.*

The food of the jack rabbit consists mainly of grass and green vegetation, of which growing grain of all kinds, clover, and alfalfa are especial favorites. It has been estimated that five jack rabbits eat as much grass as one sheep.[a] Allowing one rabbit to the acre, which surely would not be overestimating their maximum abundance, the rabbits on a 1,000-acre ranch would consume as much grass as 200 sheep. That the rabbits are a serious drain on the grass supply of the stock range, especially in the more arid parts of the State, can not be denied. It is a question if they are not even more injurious than the prairie dog, as they cover about twice the area in the State that the prairie dog does, and instead of being in colonies and keeping to a definite locality they travel about freely, seeking cultivated fields, meadows, gardens, orchards, and the best pastures. They are as independent of water supply as any of the desert mammals, and in many of the valleys must go for months without water save what is obtained from their food.

For protection from their enemies the jack rabbits depend on protective coloration, the keenness of their ears and eyes, and the length of their legs, and all they ask of a coyote is a fair start and an open field. A greyhound will pick up one on a straight run, however, and foxhounds will often tire them out if there is moisture enough for good tracking. Coyotes, foxes, and wild cats catch them apparently with a quick bound in brushy places, leaving only patches of scattered fur and a few tracks to mark the spot next morning. Hawks, owls, and eagles prey extensively upon them. Their bones were among the commonest of those scattered over the ground under a great horned owl's nest on a cliff at the edge of the Davis Mountains and under a golden eagle's nest on a cliff near Marathon.

During the morning and evening hours jack rabbits may be seen loping along the trails to their feeding grounds, nibbling grass on the green patches, standing with ears erect, on the *qui vive*, or scurrying in alarm from real or fancied enemies. In the twilight they become almost invisible, and their highly protective coloration probably serves them better by night than by day, as they are then most active. During most of the day they sit in their forms, or merely crouch close to the ground under the edge of a bush or weed, or even in the open without other protection than the blending of their gray coats with e gray desert vegetation. When they bound away from the bare ound or short grass close to your feet, the surprise is greater than en they start from under a fuzzy-topped weed, though in both ses they may have been in plain view all the time. The only home ey can claim for themselves and their young is the form, a slight pression scratched in the ground, usually under the shady side of bush or weed. They can not endure the heat of the midday sun, d in hot weather always seek some shade. I have never known one enter a burrow, though they could easily go down badger holes. e young are hidden in grass and weeds until large enough to ape their enemies by running, and they are such experts at hiding at they are rarely discovered.

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[a] 'Jack Rabbits of the United States,' by T. S. Palmer, Biological Survey. No. 8, p. 30, 1897.

Extermination of jack rabbits, even if practicable, is not desira- e, as they have considerable value for game and food purposes, aside om the interest and pleasure of maintaining a reasonable number of r native animals. When in good condition their flesh is excellent, ough usually not so tender as that of the cottontail or Belgian hare. he common prejudice against using them as food has been shown by r. T. S. Palmer to be entirely without foundation.[a]

pus texianus melanotis Mearns. Kansas Jack Rabbit.

Jack rabbits from Texline, Lipscomb, Canadian, Washburn, Hen- etta, and Vernon, and apparently also an immature specimen from ginaw, are almost typical *melanotis*. They are scarce over the rthern part of the Staked Plains, and I have seen but a single ecimen from that region and only a few individuals in life. One en close to the train near Washburn September 22, 1902, had every pearance of being the brown-backed *melanotis* instead of the paler ay *texianus*. A few others reported from Tascosa, Hereford, Wash- rn, and Gainesville are probably *melanotis*. More specimens om eastern Texas may show closer affinities with *melanotis* than ith *texianus*, as the few examined are to some extent intermediate tween the two forms.

The habits of *melanotis* do not differ much from those of *texianus*, which it is the plains and prairie representative. Instead of pending on low desert bushes for shade and concealment, the for- er usually hide in tall prairie grass, which habit may in some way count for their slightly shorter ears and smaller audital bullae and e browner coloration that constitute their principal subspecific aracters.

They are generally less numerous than *texianus* or *merriami*, and nsequently of less serious economic importance. They are also er from parasites, and therefore more acceptable as game.

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[a] See 'Jack Rabbits as Game,' in Jack Rabbits of the United States, by T. S. lmer, Biol. Surv., Bul. 8, p. 71, 1897.

Lepus floridanus alacer Bangs. Bangs Cottontail.

The cottontails of eastern Texas as far west as Port Lavaca and Gainesville are readily distinguished from *floridanus* by the small audital bullæ, and from *chapmani* by the darker colors, in both of which characters they agree with *alacer* described by Outram Bangs, from Stilwell, Ind. T. The darkest specimens are from extreme eastern Texas, but to the westward the transition into the lighter, grayer *chapmani* takes place mainly along the line where timber and thick grass prairie change to mesquite plains.

The cottontails are common over practically all of eastern Texas, living in the densest timber and brush patches, in the open woods, in the rich prairie grass, or about fields and buildings. Where there are no dogs to chase them, their favorite home is under a house or other building. In the woods an old log, tree top, or brush heap usually protects them, though they are often found crouched in their forms under a bunch of briers, weeds, or bushes. On the prairie they often jump from under a tuft of overhanging grass and run to the nearest brush or weed patch for cover. They rarely find burrows to make use of and apparently never dig them.

Nowhere have I found them more than moderately common or in any way a serious pest. Their value as a food and game animal probably compensates for what little mischief they do in cutting off young fruit and forest trees, and for the small amount of grain and vegetables they injure in fields and gardens. If in places they become troublesome, it is easy to thin them out by hunting them with dogs, but usually the hawks and owls keep their numbers sufficiently reduced.

Lepus floridanus chapmani Allen. Chapman Cottontail.

Lepus floridanus caniclunis Miller. Proc. Acad. Nat. Sci. Phila., p. 388, Oct. 5, 1899. From Fort Clark, Tex.

Lepus simplicicanus Miller. Proc. Biol. Soc. Wash., XV, p. 81. Apr. 25, 1902. From Brownsville, Tex.

This small-eared cottontail ranges from Rockport, Brazos, Henrietta, Mobeetie, Canadian, and Lipscomb, westward to Stanton and Comstock, south to Brownsville in Texas, and across into Mexico. It is a small, pale-gray form of the *floridanus* group, amply covered by the name *chapmani*, given by Doctor Allen to Corpus Christi specimens. It is quite distinct from the long-eared cottontail (*Lepus arizonæ minor*), with which it occurs at Stanton, Comstock, Del Rio, Fort Clark, and along a wide strip of country where the ranges of the two overlap. It inhabits the semiarid mesquite country of Lower Sonoran zone and usually is abundant throughout its range.

At Corpus Christi, and thence to Brownsville and Del Rio, these little rabbits live among the big bunches of prickly pear and in the thickets of mesquite and catsclaw, finding in the thorny cover the same protection that the wood rats and many other mammals do, and seeming to ignore the presence of thorns in and along their trails. One of their favorite resorts for a midday nap is in or among the big flat pads of a prickly pear, where they will stick to their form until fairly forced out. In the still more dense and thorny thickets of *Zizyphus* and *Momesia pallida* it is impossible to force them out. In the evening and morning hours they may be seen hopping around the edges of these thickets, where they are often comparatively tame, so confident are they of being able to dodge quickly into a safe retreat. In the country about Kerrville, and westward to Devils River, they are less common, and usually are found in the oak thickets or among junipers and scrub oaks, but the country does not seem to suit them as well as the more open mesquite region farther north at Llano, where they are abundant in the thickets of mesquite and *Zizyphus*. At Mobeetie, Miami, and Lipscomb, Howell found them inhabiting the brushy creek bottoms, and at Canadian both the brushy bottoms and the plum thickets over the sand hills. He says they were very wild, and that none were seen on the open country where the long-eared *minor* ranged.

I have never found these rabbits making use of burrows or of openings in the rocks.

Like all the cottontails, they are excellent food, and are usually free from grubs and other parasites. The young are especially delicious, and as white and tender as quail. Complaints are rarely made of the harm they occasionally do in orchards and gardens, as this seems to be compensated by their value as game.

Lepus arizonæ minor Mearns. Desert Cottontail.

The long-eared desert cottontail can be distinguished from the short-eared *chapmani* by its much larger audital bullæ with even more certainty than by its longer ears, and, as the two occur together over a wide stretch of country, this distinction is important. It is the common cottontail of western Texas, and extends from El Paso and along the Rio Grande east to Wichita Falls, Tebo, Colorado, San Angelo, Fort Clark, Cotulla, and San Diego, south to Rio Grande City, and north to Tascosa and Lipscomb. The eastern edge of its range overlaps the western edge of the range of *chapmani* in places for a distance of a hundred miles or more, where the two occur commonly together. While distributed mainly over the arid Lower Sonoran zone, it ranges into Upper Sonoran in the Davis and Guadalupe Mountains and on the Staked Plains, but perhaps not farther than a rabbit would wander in a few warm months.

Unlike *Lepus chapmani*, these cottontails are largely inhabitants of the plains and open country, caring little for cover when they can find prairie dog or badger holes for safe retreats. They most conspicuous and abundant in a half-deserted prairie- in a barren valley, where they sit under a bush or weed until when they rush to the nearest burrow and disappear, or haps, at the edge to see if they are pursued.[a] Where the prairie-dog holes, badger holes are usually common throu range of this rabbit, and a large kangaroo rat burrow is o use of in an emergency. Openings in and under rocks favorite retreats, and rabbits are usually common along of cliffs and in canyons and gulches where, besides the natur among the rocks, they make use of burrows where skunks an

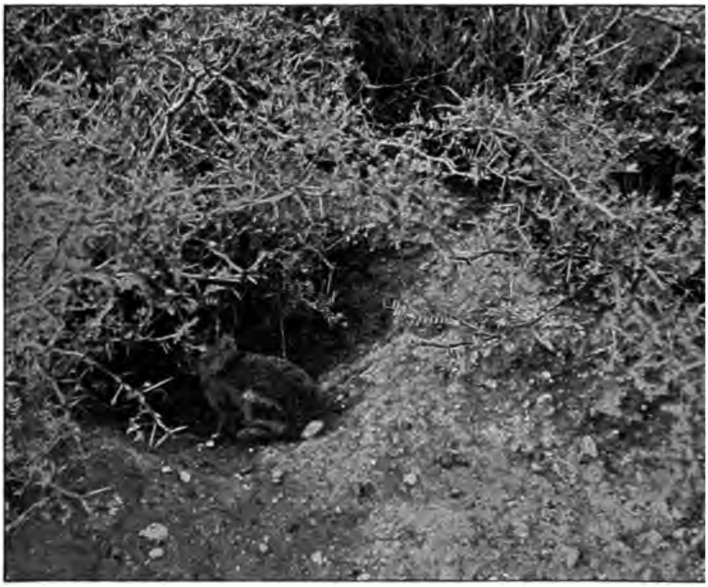

FIG. 20.—Long-eared cottontail (*Lepus a. minor*) at badger hole under Pecos Valley.

have dug out smaller rodents or made dens under big Dense tangles of brush and impenetrable cactus patches resorted to for cover, but nowhere within the range of the there anything more nearly approaching real woods than mesquite and junipers, with the exception of willows and co on some of the river bottoms, which the cottontails seem Like jack rabbits, they seem to feel more secure in the ope where safety depends on keenness of sight and hearing and foot.

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[a] At Lipscomb and Canadian, Howell found them inhabiting old holes to such an extent that they were called by the ranchmen " rabbits" or "dog rabbits."

Over much of their range they are usually very abundant. While on the train going from Wichita Falls to Seymour, a distance of about 50 miles, I counted 16 of these rabbits, and from Wichita Falls to Childress, a distance of about 100 miles, I noted over 30. At Sycamore Creek in half an hour Lloyd counted 18, and in many places we found them equally numerous. Around ranches they are generally shot for food or chased away by dogs, so that there is little complaint of injury to crops. The amount of range grass consumed by them under ordinary circumstances can not be very great, but without natural enemies they would soon become so numerous as to be a serious pest.

They breed rapidly, but are preyed upon constantly by coyotes, foxes, wildcats, hawks, eagles, and owls. Under the nesting cliff of a great horned owl at the west base of the Davis Mountains parts of fully 100 skulls of this cottontail were found among other bones in the owl pellets.

As food these cottontails are equal to any rabbit and when young they are especially delicious. In camp they are often the only available fresh meat. As other game becomes scarce their importance as food and game will be greatly increased.

Lepus arizonæ baileyi Merriam. Plains Cottontail.

Two specimens of cottontail from Texline and one from Buffalo Springs, 20 miles to the northeast of Texline, can be referred to *baileyi* better than to *minor* or *arizonæ*, although not typical of either form. It is a question if the Lipscomb and Tascosa specimens referred to *minor* do not shade also toward *baileyi*, which appears to be an Upper Sonoran plains form of the *arizonæ* group.

At Texline Howell says that these rabbits are restricted to the sagebrush draws near town. When started from the sagebrush (*Artemisia filifolia*), they usually [illegible] for the [illegible] or else run into a burrow. They are very shy and if [illegible] they quickly run out of sight.

Lepus pinetis robustus subsp. nov. Mountain Cottontail.

Type from Davis Mountains, Texas, [illegible] No. [illegible] U. S. Nat. Mus., Biological Survey [illegible] Vernon Bailey. Original No. [illegible].

General characters.—Similar to *L*[illegible] with relatively narrower [illegible] prominent postorbital processes.

[illegible] Winter pelage.—[illegible] rump light ashy gray, [illegible] lower parts white with buffy gray throat patch. The [illegible] summer pelage is not known.

Cranial characters.—Skull larger than in *pinetis* or *holzneri*, with relatively narrower braincase, slightly larger bullæ, and conspicuously wider, more prominent postorbital processes.

Measurements.—Type specimen ♀ ad.: Total length, 460; tail vertebræ, 55; hind foot, 104; ear from notch (measured dry), 67. Average of 5 adults from western Texas: Total length, 458; tail vertebræ, 59; hind foot, 103.6; ear from notch, 68.

Skull of type.—Basal length, 60; nasals, 32; zygomatic breadth 34; greatest breadth of braincase, 26.5; mastoid breadth, 25.5; interorbital breadth, 19.

Remarks.—This large brush rabbit needs comparison only with *pinetis* and *holzneri*, from both of which it differs enough to form a good subspecies, and from the range of which it is apparently entirely cut off by intervening valley country. From *arizonæ* and its subspecies it is entirely distinct, differing widely in size and cranial characters and occupying the same ground in the lower part of its range. It is a Transition zone species, ranging from 6,000 to 8,000 feet in the Davis and Chisos mountains, rarely coming down the brushy slopes into Upper Sonoran zone. A specimen collected in midwinter in Presidio County was in the Upper Sonoran zone near the edge of the Chinati Mountains, at about 4,200 feet, where it may have wandered down along the brushy creek from a higher level.

It lives in brushy and timbered country and makes runways through the thickets, which, when started, it follows at a lively speed and with much noise. It is almost as large and heavy as the varying hare, and needs only to be seen or heard running to be distinguished from the light, slender *minor*. While many were seen or heard in the Davis and Chisos mountains, but few specimens were collected, owing to the difficulty of getting shots at them in the thickets. They seem to be entirely free from grubs and other parasites and are fine eating.

Lepus aquaticus Bachman. Swamp Rabbit.

The swamp rabbits from near the coast of southeastern Texas agree in general appearance with *aquaticus*, in referring them to which species I follow Doctor Allen, although more specimens from this region, as well as more of typical *aquaticus*, are necessary to a final decision. Specimens examined: Selkirk Island, Matagorda County, 1; Bernard Creek (12 miles west of Columbia), 2; Austin Bayou (near Alvin), 1. Oberholser reported them as common in the moist woods near Beaumont, and Hollister found them "exceedingly numerous at Sour Lake, especially about the wooded islands." Lloyd reported them from Selkirk Island at the mouth of the Colorado River and in the salt marshes near Matagorda. My own acquaintance with the species has been in the Big Thicket of Hardin County, Tex., and in southern Louisiana, where they live in swamps, marshes, and low brushy woods near the bayous, making trails that often lead through shallow water. They usually jump from under old logs or tangles of briers and underbrush and go dashing off with a heavy thumping run, but usually with speed enough to escape the dogs. Fires are said sometimes to drive them out of the swamps and marshes by hundreds. In the Big Thicket in December, 1904, they were especially abundant under the dense growth of palmettoes and tangle of vines. At this season the ground was dry, but the quantity of large flattened pellets covering the tops of old logs suggested that during wet weather the rabbits spent much of their time on the logs.

Late in the following March Gaut found them abundant in this region during high water, and was informed by Mike Griffin, a hunter living on Black Creek, that they were great swimmers, and when chased by the dogs would invariably swim back and forth across the creeks. One female examined contained five embryos and two others were nursing young.

Lepus aquaticus attwateri Allen. Attwater Swamp Rabbit.

Swamp rabbits are common along the streams of eastern Texas as far west as Port Lavaca, San Antonio, Austin, and Gainesville. Specimens from Richmond, Antioch, Joaquin, Troup, and Gainesville are large and gray like typical *attwateri*, and can be referred to nothing else. They are reported as common in the swamps or bottom lands at Arthur, Texarkana, Jefferson, Waskom, Rockland, Brenham, and near Elgin. Those reported from Conroe and Jasper are probably nearer to *aquaticus*.

In habits these rabbits are similar to *aquaticus*, living in the timbered bottom lands along the rivers, often among the palmettoes, or in wet, half-swampy places in the woods. On the Brazos bottoms, near Richmond, I found them under old logs and brush in the densest woods, and at Troup, Loring reported them as hiding in fallen tree tops or under roots of trees and brush piles in low, swampy places. H. P. Attwater says:

> When frightened from their hiding places and chased by dogs they take refuge in hollow trees and in holes in the river bluffs. The dogs seem to have more difficulty in trailing them than they do the cottontails and jack rabbits, the swamp rabbits often eluding the hounds by taking to water. I have seen them on several occasions swimming across the river while the dogs were hunting for them on the other side.[a]

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[a] Bul. Am. Mus. Nat. Hist., VII, p. 328, 1895.

Felis hippolestes aztecus Merriam. Mexican Cougar; Mountain Lion; Panther.

The specimens of mountain lion from Texas available for determination of the species are few, and their status is unsatisfactory; but they indicate that at least the western part of the State is inhabited by *aztecus*. Two skulls of females from the Davis Mountains and one from Brownsville do not possess important specific characters, but they and a flat skin from the Davis Mountains and one from near Boquillas agree with *aztecus* more nearly than with any other species. A fine male seen in the San Pedro Park, at San Antonio, October 30, 1904, said to have come from Langtry, was in the light-gray coat of *aztecus*, and a nearly perfect skull of an old male from 20 miles north of Comstock shows the best-marked characters of that species.

In the rough and sparsely settled western part of the State mountain lions are still fairly common in certain sections, where they often lay a heavy tribute on colts, calves, and sheep. At Langtry Gaut reported them in 1903 as "quite common a few years ago, but now scarce," and adds: "One was shot in a pasture about half a mile from the station last winter, and an old hunter (Mr. E. B. Billings) at Samuels informs me that the stomach of one that he killed near Langtry a few years ago contained part of the foot of a raccoon and also some of the remains of a gray fox." Gaut reported a few panthers in the Franklin Mountains the same year, and said that he was shown a mule killed by one. The mule's neck showed deep gashes which had been cut by teeth and claws. Large numbers of colts were said to be killed every year in these mountains by panthers. Near Oakville, Live Oak County, Mr. F. A. Lockhart reported that a horse and two colts had been killed by a panther July 25, 1895, and that a hound was killed the next day by the same animal.

The rough desert ranges, full of canyons, cliffs, and caves, are the favorite haunts of the panthers, and will be their last strongholds, not only because of the advantages they offer for foraging but because of the protection they afford from hounds and hunters. In the desert mountains just north of Van Horn in August, 1902, a panther and I were mutually surprised at meeting in a narrow gulch, he evidently expecting a venison supper, and I, in my search for rock squirrels, discovering his big, round, yellow face between the rocks above me. I drew my sight a little too fine and caught the rock just under his chin with no more damage than to fill his eyes with rock dust and cause a quick retreat behind the crest of the ridge. I was scarcely more disappointed than was the ranchman in the next valley whose colts had been disappearing at frequent intervals. In the Davis Mountains these cougars have been hunted with hounds until scarce, [illegible] the Santiago range, in the Chisos Mountains, and along the [illegible] of the Rio Grande and Pecos they are still common. A few are [illegible] even on the edges of the Staked Plains. On a ranch [illegible] of Monahans Cary saw the skin of one that had been [illegible] in July, 1902. It was a very large female, and was [illegible] measured 11 feet in total length. The size strongly suggests [illegible], which it ought to be from geographic considerations.

The [illegible] inhabiting the timber and swamps of eastern Texas [illegible] different from either *[illegible]* or *hippolestes*, but [illegible] the Florida panther (*[illegible]*), the Adirondack panther [illegible] something else, will remain doubtful until specimens [illegible] from the region. Baird speaks of the redness of a skin [illegible] Captain Marcy on the Brazos River (Pac. R. R. Rep., VIII, 84, 1857), but the skin can not now be found. An old female panther, which died in the National Zoological Park January 19, 1900, was a gift August 12, 1892, when about two or three weeks old, near Memphis, Tex., in the Red River Valley, east of the Staked Plains. The skin of this animal, now in the National Museum collection, agrees fairly well with skins of *hippolestes*, but the skull does not agree with any of the skulls in the National Museum and [illegible] probably due to life-long confinement.

[illegible] of eastern Texas panthers are reported as formerly common [illegible] as very rare or entirely extinct. Individuals have [illegible], however, within a few years [illegible] the swamps [illegible] from Jefferson in the northeastern part and Sour Lake in the southeastern part of the State. At Tarkington Prairie Mr. A. W. [illegible] a few panthers when he [illegible] 1880, [illegible]. In the Big Thicket of Hardin County a few [illegible] in past years, and [illegible] of Sour Lake, says a very large [illegible]. He saw its tracks in the [illegible].

Felis onca hernandezi (Gray). Jaguar.

[illegible] Baird, Mamm. N. Am. [illegible]

The jaguar, the largest of North American [illegible] southern Texas [illegible]

[illegible] jaguar killed [illegible] agrees very closely [illegible] near Mazatlan, M[illegible] yellower and the [illegible] important [illegible] skin but the Texas [illegible] of typical *onca* from B[illegible] a detailed description of [illegible] way with this [illegible] the eastern part of the State to Louisiana and north to the Red River, is now extremely rare. Occasionally there is a report that one has been killed, but in very few cases have the reports been substantiated by specimens. A skin from the Brazos River, Texas, without a date, but entered in the National Museum Catalogue in 1853 and described in detail by Professor Baird in the Mexican Boundary Survey (Vol. II, part 2, p. 6), seems to have disappeared. This specimen was obtained from J. M. Stanley, but no more definite locality was given than 'Brazos River.' The following note from H. P. Attwater was published by Doctor Allen in his list of mammals of Aransas County Tex.[a] "Captain Bailey says he formerly owned a fine skin of a jaguar killed on the point of Live Oak Peninsula by J. J. Wealder and A. Reeves in 1858, but has not heard of any in this neighborhood since."

In reply to a request for detailed information relating to a mounted specimen of a jaguar mentioned in a previous letter, Mr. H. P. Attwater writes under date of June 4, 1904, as follows:

> Since writing I have been in San Antonio, and while there hunted up my friend Mr. Frank Toudouze, and from him obtained some information about the jaguar referred to in previous communication. Mr. Frank Toudouze, who is now living in San Antonio, remembers the circumstances very well, and tells me that the jaguar was killed by his brother, Henry Toudouze, and party of hunters in 1879, about 10 miles south of Carrizo Springs, in Dimmit County, Tex. He tells me that it was a male, and even at that time considered a rare animal in that part of Texas. Mr. Henry Toudouze died a few years ago, but I have heard him tell about the killing of this particular animal many times, as well as hearing his father and brothers speak of it. When I came to Texas it was in Mr. Gustave Toudouze's (the old gentleman) collection, and he and I took it with other specimens to the New Orleans Exposition in 1884, as a part of the Texas Natural History Exhibit of which we had charge. At the close of the New Orleans Exposition it was brought with our collection back to San Antonio, and subsequently taken to Mexico by Mr. Frank Toudouze, who tells me that he sold it with the rest of the collection to the officials of the State Museum at Saltillo, State of Coahuila, and he says he has no doubt that the specimen is still there.

In 1902 Oberholser heard of a jaguar that was killed south of Jasper a few years before, and also obtained reports of the former occurrence of the species along the Neches River near Beaumont and in the timber south of Conroe. There have been several reports from different sources of one killed near the mouth of the Pecos in 1889, or near that date, and in 1901 Oberholser got a record of one killed south of Comstock "some years ago," but without a definite date. At Camp Verde, Cary was told by a Mr. Bonnell of a jaguar killed in 1880 at the head springs of the Nueces River, but this may have been the Toudouze specimen from Carrizo Springs.

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[a] Bul. Am. Mus. Nat. Hist., VI, 198, 1894.

The skin and skull of a fine old male jaguar killed near Center City, Mills County, Tex., September 3, 1903, through the efforts of Mr. H. P. Attwater, the enthusiastic naturalist of Houston, Tex., have been secured and safely lodged in the National Museum. Through the courtesy of Mr. Gerrit S. Miller, jr., assistant curator of mammals in the U. S. National Museum, the correspondence relating to the capture of the animal and the securing of the skin and skull for the museum has been placed at my disposal. The following extracts from this correspondence are of special interest.

In a letter of March 21, 1904, Mr. Attwater wrote to Mr. Miller:

> Last fall I heard that a jaguar had been killed near Goldthwaite, in Mills County, north of the Colorado River, in west central Texas, and wrote to parties in that section for particulars, but with poor satisfaction, so made up my mind to go there the first opportunity for the purpose of getting at the facts. I was so much engaged with my work that I was unable to spare time to do this until several weeks ago, but I am glad to say that I am now able to report very satisfactory results, and that I found the skull and hide still there, also ordered photographs (from the negative taken at the time), which have just come to hand. I take pleasure in sending you one with this letter, and later on will send you full particulars, with date of killing, etc., the most important of which I already have.
>
> * * * * * * *
>
> In regard to the killing of the jaguar, I understood from Mr. Hudson, who skinned him, and from others, that they found it accidentally, and that they were hunting wildcats at the time they ran across him. I was told while I was there that another jaguar had been reported in the same locality after this one was killed, and it was supposed that there was a pair of them, but as far as I could find out nothing had been heard or seen of the other one for some time past. * * * In regard to how the jaguar came there, my idea is that it strayed there probably with its mate from the Rio Grande region, which it could easily have done by the route indicated on the inclosed map. The character of the country all along this route from the Rio Grande to Mills County is similar and not thickly inhabited, and I am inclined to think the animal made its way up the San Saba River and across the Colorado into Mills County. I took particular note of the country around Goldthwaite and in that part where the animal was killed it is rough with rocky ridges which they call 'mountains,' running parallel with the creeks and rivers, with uneven valley lands between the streams and the mountains. There is no tall timber, but the entire country is covered with a thick brush or chaparral, consisting chiefly of shin oak thickets known as the 'shinnery,' also sumac thickets and Spanish oak clumps with live oak trees scattered among them. On the lower flats there are considerable mesquite trees.

Later Mr. Attwater wrote as follows:

> I send you by express box containing the skin and skull of jaguar. * * * Miss Julia Kemp, the photographer in Goldthwaite, very kindly promised to write to the parties who killed the animal to get the data and other particulars for me. I herewith inclose you the correspondence, together with a letter she sent, received from Homer Brown, one of the parties in the "fight."

The following letter from Homer Brown was addressed to Miss Julia Kemp, March 20, 1904:

> Yours of 15th at hand. In regard to the jaguar, we killed him Thursday night, September 3. I will give some of the particulars. Henry Morris came to go hunting with me that night. I had a boy staying with me by the name of Johnnie Walton. We three took supper at my home and then started for the mountains, 3 miles southwest of Center City, where we started the jaguar just at dark. We ran him about 3 miles and treed him in a small Spanish oak. I shot him in the body with a Colt .45. He fell out of the tree and the hounds ran him about half a mile and bayed him. I stayed with him while Morris went to Center City after guns and ammunition. In about an hour and a half he came back and brought several men with him, so then the fight commenced. We had to ride into the shinnery and drive him out, and we got him killed just at 12 o'clock that night. We commenced the fight with ten hounds, but when we got him killed there were three dogs with him, and one of them wounded. He killed one dog and very nearly killed several others. He got hold of Bill Morris's horse and bit it so bad it died from the wounds. * * * The men in the chase were three of the house boys, Al and Joe Tangford, George Morris, Bill Morris, Thad Carter, Claud Scott, Henry Morris, Johnnie Walton, and myself. The jaguar measured 6½ feet from tip to tip, 36 inches around chest, 26 inches around head, 21 inches around forearm, 9 inches across the bottom of foot; weight, 140 pounds.

Felis pardalis limitis Mearns. Ocelot; Leopard Cat.

Felis pardalis Baird, Mamm. N. Am., 87, 1857 (in part).

Felis limitis Mearns, Proc. Biol. Soc. Washington, XIV, p. 146, 1901.

The ocelots are still found in brushy or timbered country over southern Texas, as far north as Rock Springs and Kerrville, and up the Pecos Valley to the region of Fort Lancaster. One killed near the Alamo de Cesarae Ranch, in Brewster County, between Marfa and Terlingua, in 1903, was reported by Mr. G. K. Gilbert, and later its beautiful light-gray skin was purchased from Mrs. M. A. Bishop, of Valentine. This seems to be the westernmost record for the State. Farther east ocelots are still reported as very rare about Beaumont and Jasper, near the eastern line of the State, and farther north, near Waskom and Long Lake. Early records carried their range across into Louisiana and Arkansas, but it is doubtful if at the present time they are to be found in the United States beyond the limits of Texas. Most of the records are from hunters, ranchmen, or residents of the country, who know the animal by the name of ocelot or leopard cat, or describe it as a long-tailed, spotted cat the size of the lynx. In 1902 at Sour Lake Hollister reported "several so-called leopard cats killed near there," and says: "They are described as about the size of the wildcat but of a different build, spotted and with a long tail." Near Beaumont Oberholser reported them as occasionally killed in the woods along the Neches River. In Kerr County Mr. Moore, the sheriff, told me that he saw a beautiful skin of a large, long-tailed, *spotted cat* that was killed 10 miles south of Kerrville the latter part [illegible] At Rock Springs in July of the same year Mr. [illegible] that each year a few ocelot skins were brought into [illegible]. In his report from Sheffield Cary says: "I am [illegible] leopard cats are fairly common in the cedar brakes [illegible] Pecos southeast of here." In 1899 Mr. Howard Lacey, the [illegible] naturalist of Kerr County, told me that he occasionally [illegible] while hunting with dogs for other game, and in Ja[illegible] he wrote of the species as follows:

> [illegible] seen have all been found by the hounds, usually when we [illegible] always in just the kind of country a bear would choose [illegible] part of a dense cedar brake. Once on the head of the [illegible] the hounds struck a hot trail and were just beginning to [illegible] when a splendid male ocelot sprang into a large cedar [illegible] the hounds might be on a bear trail I shot the cat at [illegible] on the saddle and rode after the hounds that were [illegible] good pace. They ran about 2 miles and then treed a female [illegible] of a steep canyon. This we also shot and I think the two were together when we started them and that they often go in pairs. They [illegible] here but I fancy that they often rest in the trees and so escape [illegible]
>
> [illegible] more muscular than the bobcat and our hounds that [illegible] work of a bobcat, find the leopard cat 'a tough customer' [illegible] have the strong odor [illegible] the larger [illegible] about being reminded of the [illegible] house at the London Zoo [illegible] to find [illegible] his hounds and [illegible] the dogs [illegible] brought out two [illegible] other occasion he killed [illegible] the [illegible] brought forth two [illegible] got them [illegible]
>
> [illegible] damage to the [illegible] They prob[illegible] what they [illegible]

[illegible] Baird. Berlandier Ms. [illegible]

[illegible] Baird, M[illegible]

[illegible]

A study of the [illegible] Biological Survey and U. S. National Museum coll[illegible] of the [illegible] and six of the [illegible] Texas [illegible] Mexico.

reveals no constant difference in cranial or external characters other than color. The striking coincidence of range and similarity of habits, as well as structure, of the red and gray cats strengthen the evidence tending to show that these supposedly distinct species present only another case of dichromatism, comparable to the black and cinnamon bear and the red and gray phases of the screech owl. A wide range of individual variation in size, shades of color, and in cranial characters is shown in the series of specimens examined. The type skull of *apache* shows the widest departure in characters, and especially in dwarfed size: but as the animal was captured when very young and kept in confinement throughout the rest of its life without becoming wholly domesticated, this may account for abnormal development.

Owing to lack of enough Central and South American specimens to show the relationship of *cacomitli*, through the several intervening forms, with typical *yagouaroundi* and *eyra*, it seems best for the present to treat this northernmost and relatively light-colored form as a species. When the relationships of the group are fully worked out it will doubtless stand as a subspecies of *yagouaroundi*.

The Biological Survey collection contains four specimens of the gray and one of the red cat from Brownsville, collected by F. B. Armstrong in 1891 and 1892, and a young one of the gray form collected by Lloyd, August 9, 1891. This quarter-grown young was reported as one of a litter of four caught by a boy and a dog in a 'resaca' near Brownsville. Lloyd also reported seeing one fresh and several dry hides of the gray cat in Brownsville, and mentioned two "ancient mounted specimens" of the red cat in Armstrong's collection there, but did not say where they originally came from. Since then Armstrong has sent to the National Zoological Park at Washington four of the red and two of the gray cats alive from the Lower Rio Grande region.

In a letter from Brownsville to Dr. Frank Baker, superintendent of the National Zoological Park, Armstrong writes:

> Eyra and yaguarundi cats inhabit the densest thickets where the timber (mesquite) is not very high, but the underbrush—catsclaw and granjeno—is very thick and impenetrable for any large-sized animal. Their food is mice, rats, birds, and rabbits. Their slender bodies and agile movements enable them to capture their prey in the thickest of places. They climb trees, as I have shot them out of trees at night by 'shining their eyes' while deer hunting. I capture them by burying traps at intervals along the trails that run through these thick places. I don't think they have any regular time for breeding, as I have seen young in both summer and winter, born probably in August and March. They move around a good deal in daytime, as I have often seen them come down to a pond to drink at midday, and often see them dart through the brush in daytime. They are exceedingly hard to tame. Their habitat is from the Rio Grande, 40 miles north of here, as far as Tampico, Mexico. Beyond that I don't know.

A 'long-tailed yellow lynx' reported by John M. Priour from west of Corpus Christi in December, 1902, may have been this species. Mr. Priour thought it might be a partially albino ocelot. Apparently the same animal was seen there two years before by Dr. Adolph Huff, of San Antonio, who thought it might be a young panther.

Lynx rufus texensis Allen. Texan Lynx.

The large, dark, and usually much spotted and lined lynx of southern and eastern Texas ranges in Lower Sonoran zone north to at least Montague and Cooke counties and west to Kinney County. An immature specimen from Antioch and three skulls and six skins from Hardin and Liberty counties carry its range to near the eastern part of the State. More material may show that the form inhabits the whole Lower Sonoran zone of Texas, including the Pecos and Rio Grande valleys, and grades into *baileyi* or overlaps it in range in the Davis Mountains country. It is common over southern and eastern Texas and especially abundant in the dense chaparral of cactus and mesquite along brushy stream bottoms and in the timbered gulches where the lower arm of the Staked Plains breaks down into the low country, and in the swamp country farther east. At Port Lavaca Oberholser reports: "The wildcats are common in places away from town where there is sufficient cover, such as live-oak thickets and the great rose hedges. In the thickets they are not so difficult to hunt, but in the hedges they have almost impenetrable cover, and it is well-nigh impossible to reach them except by trapping." He says that at O'Connorport "a good many wildcats inhabit the thicker part of the oak brush, where they can be hunted only with dogs;" on Matagorda Island "they occur in the little chaparral that grows on the island;" and at Beeville "they are common in the denser portions of the chaparral, where specimens are frequently secured not far from town." From Corpus Christi to Brownsville in 1900 wildcats were common along streams and in the chaparral, where their tracks were abundant in the dusty trails and on the muddy margins of streams and pools, but where the cover was generally too dense and thorny to admit dogs or to allow any method of hunting save by traps or poison. Lloyd states in his report that along the lower Rio Grande and in Cameron County "most of the ranchmen will not allow the wildcats to be killed for fear their ranches will be overrun with wood rats, mice, and rabbits." Not only in this region, but farther north and east this fear has been realized many times in swarms of wood rats, cotton rats, and rabbits, but the services of such predatory mammals as wildcats, foxes, and coyotes are not always recognized by the ranchmen. I have found this lynx common at Uvalde, Devils River, Kerr County, and farther east at Seguin, but *in no other locality* so abundant as in the Big Thicket of

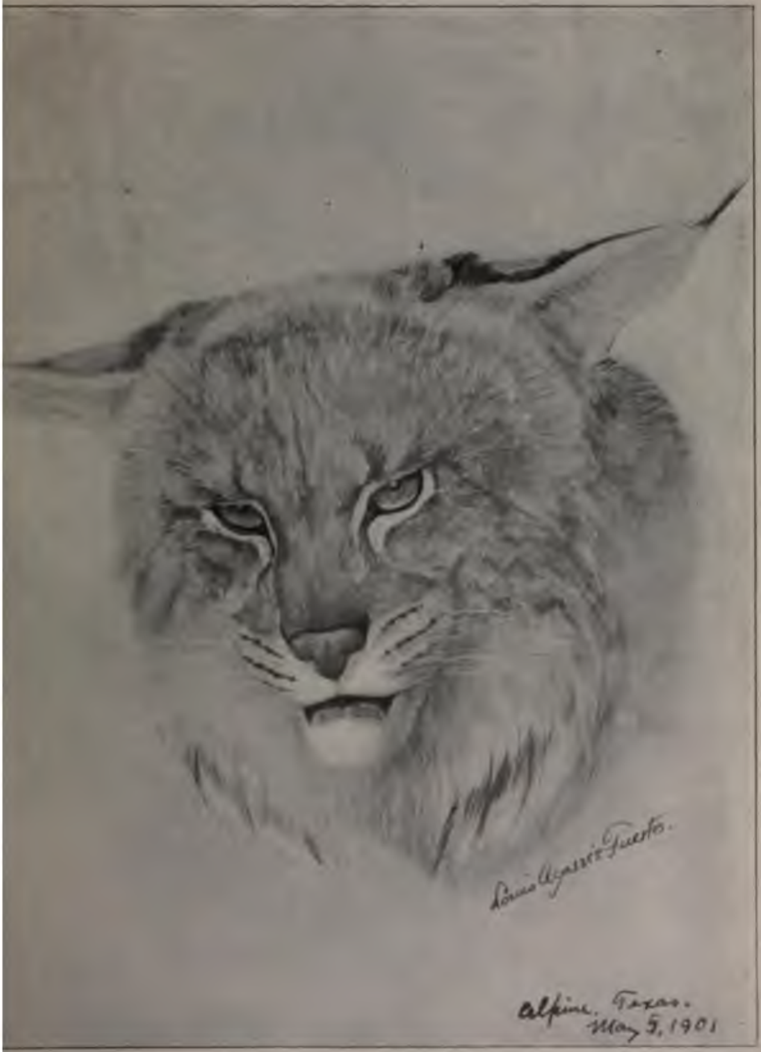
Liberty and Hardin counties. Here its tracks were seen in every muddy spot in roads and trails, and on damp mornings the dogs started one about as soon as they got into the thicket. The cat would rarely tree, but usually, rabbitlike, would run round and round in a limited circle in the thickest part of the swamp, depending on outrunning or dodging the dogs. Cat hunting is a favorite sport in this region, and the hunters usually take stands in open spots and wait for the dogs to drive the game within shot. In one case I shot the cat in front of the hounds as it passed me for the third time. It did not seem tired or much alarmed, but easily kept out of sight of the dogs.

The stomach of this individual was full of venison that had not been perfectly fresh when eaten, probably from a deer that had been wounded by some hunters a week before. The hunter with me said he had examined the stomach of one not long before that was full of wood rats, and Gaut found wood rats in the stomach of one examined at Sour Lake. The food of this, like other species of lynx, consists mainly of rodents, rabbits, wood rats, ground squirrels, gophers, and mice, with a few birds, and occasionally some poultry. There are a few complaints of their killing sheep, young goats, and pigs.

Lynx baileyi Merriam. Plateau Wildcat.

The lynx of the mountains and Staked Plains regions of western Texas, as shown by specimens from the Davis Mountains, and from near Alpine and Van Horn, and flat skins from Stanton and Odessa is indistinguishable from *baileyi*, which seems to occupy at least the Upper Sonoran zone of Texas. An immature specimen from Presidio County, a flat skin from the east base of the Chisos Mountains and a flat skin labeled El Paso [?], are referred somewhat doubtfully to this species, but good material from the Rio Grande Valley may change this decision.

The country occupied by this plateau wildcat is mainly open, arid, and rocky. Canyons, gulches, and cliffs are its favorite haunts and hunting grounds, while caves and clefts in the rocks furnish dens and safe retreats from which hunting excursions are made into the valleys and even to the edge of the plains. Fresh tracks are frequently seen where the cats have followed the lines of the cliffs, crept along narrow shelves of rock from one wood rat's den to another, or walked noiselessly in the dust under and around the great bowlders and broken talus at the base of a cliff where the cottontails hide. Most of the wildcat's hunting is done at night, but occasionally one is surprised at midday crossing a valley to another cliff or found toward evening getting an early supper. One shot among the rocks near Alpine just before sundown had already caught and eaten a wood rat, which made a good beginning for a meal. On the head of Onion


Louis Agassiz Fuertes.
Alpine, Texas.
May 5, 1901

HEAD OF PLATEAU WILD-CAT (LYNX BAILEYI).

Presidio County, in January, 1890, while watching the hawks [illegible] cottonwoods to roost one evening at sundown, I saw [illegible] among the branches overhead and slowly traced [illegible] form of a wildcat flattened along a rough [illegible] the specimen, so did not wait to see if hawks [illegible] hunt, but an empty stomach showed that he [illegible]

[illegible] some rocky corners of the cliffs one finds elon [illegible] and fur, some freshly deposited, others old [illegible] these throw important light on the food habits [illegible] of fur, teeth, and paws serve to identify many [illegible] have been eaten, and usually disclose a great [illegible] and wood rats. Traces of many smaller [illegible] feathers and bones are found, but no remains [illegible] animal. The ranchmen complain of some poul [illegible], and, still worse, a few sheep. This, with a few [illegible] birds, is about all that stands against the account of [illegible] a much larger amount on the credit side.

[illegible] readily trapped, as they rarely follow the same [illegible] kind of bait. A few are shot, and the cow [illegible] one in the open, but they are most successfully [illegible] night or early in the morning. When started, [illegible] tree or to the rocks, and are shot or driven out [illegible] smoked out of the rocks.

[illegible] Gray Wolf; Loafer; Lobo.

[illegible] gray wolf, 'loafer,' or [illegible] still common over [illegible] mountain country of western Texas [illegible] Upper Sonoran and [illegible] the State. The [illegible] which I [illegible] from [illegible] Guadalupe Mountains [illegible] from Monahan [illegible] skulls of the [illegible] the large, light [illegible] almost all of [illegible] between the [illegible] big coyote of the [illegible] and the larger, lighter colored 'loafer' of the plains to the north. At Comstock, where special bounties are paid by sheep owners for the coyote and the common red wolf, the 'loafer' is unknown. A specimen killed 20 miles north of there on the higher plains in 1901 excited especial comment and raised the question whether or not the range of the gray wolf is being extended southward.

These wolves are most abundant in and about the Davis and Guadalupe mountains and over the Staked Plains and open country east of the Pecos River. Whether they are residents in the Pecos Valley or merely wanderers between the plains and the mountains is not easily determined, but I have no record of their breeding in the low part of the valley, while they are known to breed commonly in the high country on both sides. The present abundance of the species in any given place is not easily determined, as inferences are mainly drawn from the numbers killed, rather than the numbers left alive. Personally I have known of six or eight that were killed in 1901 and 1902 in the Davis Mountains, and a few in the Guadalupe Mountains and on the Staked Plains that were poisoned or dug out of their burrows. While my own observations have been limited, they aid in determining the accuracy of numerous other reports from resident hunters and ranchmen. These reports indicate that the wolves are not decreasing in numbers rapidly, if at all, in spite of those killed by ranchmen and by professional wolf hunters. On many of the large ranches a special bounty of $10, $20, or sometimes $50, is paid for every wolf killed. Several smaller ranches often combine to offer a large bounty in addition to that paid by the county, so that wolf hunting becomes a profitable business. In such cases there is a strong temptation for the hunters to save the breeding females and dig out the young each year for the bounty, thus making their business not only profitable but permanent. The hunters also bring wolves from a distance to the ranch paying the highest bounty. The bounty system offers dangerous temptations and has never proved effectual or even highly beneficial over any large area.[a]

To protect themselves from fraud and their stock from wolves many of the large ranch owners employ wolf hunters by the month and pay them well to keep the wolves and other noxious animals from their range. On the whole, when skilled hunters can be procured, this seems by far the most economical and satisfactory method.

When opportunity offers, the 'loafer' not only kills sheep but often kills a large number, apparently for the pleasure of killing. His regular and most serious depredations, however, are on the scattered arded cattle of the range. Two or three wolves usually [illegible] ther and sometimes pull down a steer, but most of their [illegible] red from yearlings or cows. Occasionally a colt is [illegible] often. Where two or three wolves take up their resi [illegible] and kill one or more head of cattle almost every day. [illegible] become so seriously alarmed that they frequently offer [illegible] $50 or $100 apiece for the scalps. In his report from [illegible] Cary writes:

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[a] Extermination of Noxious Animals by Bounties, T. S. Palmer, Yearbook U. S. Department of Agriculture, 1896, p. 55.

> [illegible] very large female lobo wolf, which was killed on Haw [illegible] March, 1902, by Hugh Campbell. The skin when stretched on [illegible] said to have measured 8 feet 4 inches from nose to end [illegible] to the Stockmen's Association, which paid Campbell [illegible]. This female wolf was the mate to 'Big Foot,' a [illegible] the region, whose track is always recognized by an [illegible] forefoot. On the second day of my stay at Hawkins [illegible] I got on the trail of 'Big Foot' and another wolf which [illegible] own trail within two hours. Although on the trail for four [illegible] sight of them, nor did we find where they had killed any calves. [illegible] reward of $75 for 'Big Foot' by the Stockmen's Association; [illegible] hunted and trapped for a half dozen years, and [illegible] cowboy in the region, the wily old wolf still [illegible] baits, even disdaining to touch any meat not freshly [illegible]

[illegible] July, 1903, Howell reports: "Gray wolves [illegible] in this county, and a few cattle have recently been [illegible]"

[illegible] the 'loafer' is quite different from the coyote, [illegible] and assurance in the vicinity of [illegible] in the wild state and [illegible] A [illegible] grown 'loafer' that I found [illegible] town on the edge of the [illegible] puppy, full of fun [illegible] handled. Although [illegible] never tried his puppy [illegible] He was the only survivor of a litter [illegible] their eyes were open. [illegible] a bottle for seventeen [illegible] in June he [illegible] 'loafer.' He had a [illegible]

[illegible] Richardson. [illegible] Wolf.

[illegible] wolf is reported from [illegible] eastern Texas, but [illegible] or quite extinct." The more common report of a 'large wolf' or "timber wolf" in the same region [illegible] variation in color, and show that only a minority of the individuals are entirely black. Presumably they all are of the same species. Apparently there is not extant a Texas skin or skull of this wolf to show whether or not it is the same species as the one in Florida, and it is greatly to be hoped that specimens will find their way to the National Museum before the species becomes entirely extinct.

Audubon, who had more experience with these wolves in their wild state and original abundance than any naturalist will ever have again, considered the black wolf of eastern Texas, Louisiana, southern Missouri, Kentucky, North Carolina, and Florida as one species, and carefully distinguished it from the "red wolf" of southern Texas and the white or gray wolf of the plains.[a]

Canis rufus Aud. and Bach. Texan Red Wolf.

Since his work on the coyotes in 1897, Doctor Merriam has made special effort to procure specimens of the large coyote or small wolf of southern Texas. As a result there are at the present time fourteen skulls and four skins of this wolf in the Survey collection from Columbus, Corpus Christi, O'Connorport, Port Lavaca, Kerr County, Edwards County, and Laredo, in addition to two skulls in the National Museum, one from Fort Richardson, Jack County, Tex., and one from Matamoras, Mexico. Based on these specimens and the field reports of the Biological Survey a definite range can be assigned the species, covering the whole of southern Texas north to the mouth of the Pecos and the mouth of the Colorado, and still farther north along the strip of mesquite country east of the plains, approximately covering the semiarid part of the Lower Sonoran zone. As yet there are no specimens to show whether these wolves extend into the more arid region west of the Pecos. While apparently nowhere overlapping the range of the larger, lighter-colored 'lobo' or 'loafer' of the plains, they take its place to the south and east as soon as the plains break down and the scrub oak and mesquite country begins, but their whole range is shared with the coyote. The ranchmen invariably distinguish between them and coyotes, and with good reason, for the wolves kill young cattle, goats, and colts with as much regularity as the coyotes kill sheep. While paying a bounty of $1 or $2 for coyotes, the ranchmen usually pay $10 or $20 for red wolves.

Canis nebracensis Merriam. Plains Coyote.

Five coyote skulls from Canadian and three from Sherwood, Tex., and three from Clayton and two from 30 miles southeast of Carlsbad, N. Mex., agree with typical *nebracensis* skulls from Johnstown, Nebr.; while a flat skin from Monahans is as pale as the type of

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[a] Aud. and Bach., Quad. N. Am., II, pp. 130–131 and 243, 1851.

[illegible] This gives to the species a perfectly logical range over [illegible] and Llano Estacado, or the open Upper Sonoran [illegible] Texas, [illegible] specimens from many more localities are needed [illegible] range can be accurately outlined. At Lipscomb, in the [illegible] of the Panhandle, Howell reported coyotes July 10, [illegible] at some seasons." At Canadian, where five old [illegible] at Simpson's ranch on Clear Creek, he reported [illegible] here in winter in some numbers;" and at Texline [illegible] were "fairly common in this region," and added [illegible] during my stay (August 1 [illegible]), and another was [illegible] Springs."

[illegible] of the Staked Plains I have often seen the [illegible] the train and from our camp wagon, and night [illegible] camp fires have heard their long quavering [illegible] seen they were always just out of rifle range. [illegible] afraid, and in this open, level country have little [illegible]

[illegible] nebracensis texensis subsp. nov. Texas Coyote.

[illegible] southwest of Corpus Christi, [illegible] young adult No. [illegible] Nat. Mus., Biological Survey Coll. Collected by J. M. [illegible] Original No. [illegible] Colleague[illegible]

[illegible] Similar to [illegible], but darker [illegible] with lighter dentition. Smaller, brighter, [illegible] almost as richly colored as [illegible] large ears of that species. Not in the same group [illegible] and *[illegible]*.

[illegible] winter pelage buffy gray, [illegible] bright, fulvous [illegible] and belly; a strong [illegible] pelage duller and [illegible] slenderer than [illegible] narrower molar [illegible]

[illegible] *of type.* Total length [illegible] collector); hind foot, [illegible]

[illegible] Basal length, [illegible] breadth, [illegible] of upper [illegible]

[illegible]

southern Texas and apparently eastward on strips of prairie as far as Gainesville and Richmond. There are vague reports of a small wolf occurring farther east on the coast prairie even to the border of Louisiana, but specimens are needed before these reports can be associated with definite species. East of the semiarid mesquite region coyotes are rare and probably mere stragglers. True to their name of prairie wolf, they do not enter the timbered country to any extent, although at home in the scrub oak, juniper, mesquite, and chaparral, as well as over the open prairies of the southern part of the State. In the extreme southern part of the State their range is slightly overlapped by that of the little *microdon*, and in the extreme western part by that of *mearnsi*, while specimens from the northern Pan Handle country and Staked Plains are nearer to *nebracensis*.

In spite of the enmity of man, in spite of traps, poison, gun, and dogs, the coyote over most of his old range fairly holds his own. Combining with the cunning and suspicion of the fox a speed and endurance that almost insures his safety from ordinary hounds, he has little to fear except an occasional long-range shot or the traps and poison of the professional coyote hunter.

On many of the large ranches men are employed by the month to kill the coyotes, lobos, and panthers, and some of these men have attained such skill as to be able almost to extirpate the coyotes over a considerable area. But the coyotes are wanderers, and while they soon gather where food is abundant and easily procured, they quickly leave an inhospitable region for better hunting grounds. Civilization has little terror for them. I have heard them howling near many of the little towns and ranches, where they were attracted by the smell of freshly killed beef or by carcasses that were far from fresh, and near a ranch corral have found many dead coyotes poisoned at the carcass of a cow. After dark they show little fear of the ranch dogs, and sometimes seem even to invite a chase. In fact they not infrequently cross with the ranch dogs and produce hybrids with erect ears and wolfish appearance. I have seen several of these hybrids with characters that substantiated the statement that they were half coyote. At San Pedro Park, San Antonio, I was shown a 6-months-old cross between a coyote and shepherd dog, bred and born in the zoo. Except for being nearly black it had the general appearance of a coyote. It was kept chained in the open and was on friendly terms with the keeper.

About our camps the coyotes on rare occasions are surprisingly familiar, coming close to the camp wagon, especially if there is fresh meat in it, though usually paying their visits after dark. Sometimes the first man up in the morning gets a glimpse of one sneaking away or on rare occasions gets a good shot within easy range. Except iring the breeding season, when they are very quiet, their frequent renades are our regular camp music.

Within certain limits the credit and debit sheets of the coyote are ll balanced. On the one hand, he kills many sheep and a few ats, some poultry, and considerable game. On the other hand, e bulk of his food the year round consists of rabbits, prairie dogs, ound squirrels, gophers, wood rats, mice, and all the small rodents at come in his way. An unusual increase of jack rabbits in any gion is always followed by a corresponding influx of coyotes, hich probably accounts in part for the often observed fact that the years following their maximum abundance jack rabbits are nusually scarce.

At times the food of the coyote consists largely of fruit, including at of several species of cactus, juniper and forestiera berries, permmons, and the sugary pods of mesquite; but in times of scarcity piece of rawhide garnished with a few horned toads, lizards, and ome horse manure suffices for a meal.

anis mearnsi Merriam. Mearns Coyote.

Four good specimens, skins and skulls, of coyotes collected near El Paso late in February, 1903, by James H. Gaut are *mearnsi* in lightly worn and faded pelage. One skull from near the Texas and New Mexico line, in Salt Valley, at the west base of the Guadalupe Mountains, a good skin and skull from the same valley a little farher north, several specimens from the edge of Tularosa Valley, hree old skulls from Sanderson, and two from Samuels, near the mouth of the Pecos, a skull from Grand Falls, in the Pecos Valley, nd one from 30 miles southeast of Carlsbad, N. Mex., all belong to his slender, bright-colored desert form of the small-toothed coyotes. From the locality 30 miles southeast of Carlsbad, with the skull of an ld male that is unmistakably *mearnsi*, were collected two skulls of *ebracensis*, while from Sanderson and Salt Valley there are skulls that I can refer only to *texensis*.

There is not yet material enough to show whether *mearnsi* grades into *microdon* farther south or into *estor* farther north, but it evidently overlaps the range of both *nebracensis* and *texensis*. Nor are there any specimens from the Davis Mountain plateau to show what form or forms occur there. *Canis mearnsi*, so far as known, is Lower Sonoran in range.

Coyotes are common throughout the extremely arid valleys of western Texas, including the Pecos and Rio Grande valleys south to their junction. Distance from water seems to have no effect on their abundance, although in this region they can hardly find a spot more than an easy night's journey, 20 or 30 miles, from open water. We find their tracks along every road and trail, and often see one of the animals loping across the valley or watching us from a ridge, and frequently hear them from our evening camp fires. At El Paso in 1889 I jumped one from under a creosote bush, where it was sleeping at midday, within rifle shot of the town, and at another time saw four together on the mesa half a mile out from the railroad station. At Fort Hancock Gordon Donald reported them in 1902 as very abundant, and said: "I heard them calling in the evenings, and the Mexicans had several young ones that they had caught in the vicinity. A ranchman told me that in the low foothills where his ranch was situated he saw two or three coyotes every day."

Canis microdon Merriam. Small-toothed Coyote.

This little dark-colored coyote of the lower Rio Grande Valley overlaps the range of *texensis* in southern Texas. Specimens from Brownsville, Roma, and Alice show all that we know of its range in the State. These localities indicate that it is a chaparral rather than a prairie species, but there is nothing to prove that its habits are different from those of *texensis*.

Vulpes fulvus (Desm.). Red Fox.

Apparently the red foxes are not natives of Texas,[a] but since their introduction they are becoming locally common, especially over the eastern half of the State. Oberholser obtained reports of their occurrence at Texarkana, Jasper, and Austin; Hollister, at Antioch, Rockland, and Sour Lake; and Cary, from Kerr County and along Howard Creek and the Pecos River. The following extract from a letter from Mr. T. H. Brown to Mr. H. P. Attwater is, as Doctor Allen says, a document of historic interest:[b]

> I was the first to introduce 'red foxes' into this part of the State. We had exchanged our old-time native hounds, or, as they are usually called, 'pot lickers,' for the Walker dogs from Kentucky, and the gray foxes proved themselves no match for these dogs, only being able to run from twenty to forty-five minutes ahead of them. Having the dogs, it became necessary to get game that would give them a respectable race. Accordingly, in 1891, I imported from Kentucky and Tennessee 10 red foxes and placed them among the Bosque brakes, about 4 miles above where it empties into the Brazos River. They gradually scattered over a large area of country. The next spring (1892) I again brought in 23 more reds from the older States, planting 13 of them again among the Bosque brakes and 10 of them on White Rock Creek, on the east side of the Brazos River. These foxes afforded us some fine sport; but they, too,

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[a] See Aud. & Bach., Quad. N. Am., II, 271, 1851.

[b] Extract of letter from T. H. Brown, Waco, Tex., in Bul. Am. Mus. Nat. Hist. VIII, p. 77, 1896.

ly scattered, only a few remaining in the neighborhood of their adopted home wandering off through Bosque and Erath counties. The next I only succeeded in getting 2 reds from the East and planted these Bosque and they remained and are still affording fine races. spring of 1895 I again planted 5 reds on the river near Lover's Leap. he waters of all the Bosques mingle with the waters of the Brazos the bluffs here are 200 feet high and have a great many caves in nd these last foxes seem well satisfied with their new home. Occa I hear of a red fox in various parts of this (McLennan) county, and leased that within a few years they will be as numerous here as in the es

ormed that Messrs. Eli and James Rosborough and Capt. T. H. Craig hall, in Harrison County, some ten or fifteen years since planted quite er of reds in that, the eastern, part of the State, and occasionally they where they have located off some 20 or 30 miles from where origi anted loose.

as. D. Rogers has, I think, during the spring of 1895, planted some 6 the Brazos bottom farms in Brazos and Washington counties. I should that in all there have been at least 100 red foxes imported and planted tate.

velox (Say). Swift: Kit Fox.

ar as known the swift in Texas ranges only over the Upper a Staked Plains. It is reported at Tascosa and Washburn northern end of the plains and near Stanton and Midland at thern end. In 1902 Cary secured five flat skins at Stanton, s the ranchmen reported the swifts as scarce there in com with their numbers in former years. Most of these skins secured by poison put out in winter, when the swifts were come to the poisoned bait generally the first night after it was , while the coyotes usually waited until later.

macrotis neomexicanus Merriam. New Mexico Desert Fox

little desert fox has been taken in the Rio Grande, Tularosa, [illegible] valleys just north of the Texas line, and one specimen [illegible] James H. Gaut in Texas 10 miles north of El Paso. It [illegible] from as far south as the mouth of the Pecos. A flat skin t in to the store at Sierra Blanca in December, 1889, had the eristic large ear of the group, the ear measuring 78 mm [illegible]. Apparently the range of the species corresponds [illegible] to that of *Dipodomys spectabilis* [illegible] the open desert valleys [illegible] Lower Sonoran zone. It is by no means [illegible] in the region [illegible] of the ranchmen have never [illegible] it from the common and much larger and darker colored [illegible] of the genus *Urocyon*.

Urocyon cinereoargenteus scotti Mearns. Gray Fox.

Urocyon cinereoargenteus texensis Mearns.[a] Proc. U. S. Nat. Mus., XX, Advance Sheet. January 12, 1897, p. 2.

The gray fox is common over all the western half of Texas, except on the open plains. It is mainly an inhabitant of the timbered or brushy country, living in hollow trees or logs, but preferably in dens among the rocks. It lacks the cunning and swiftness of the red fox, is easily caught in traps, and quickly overtaken by the hounds, except where it can keep in dense cover. Often after a short run, and sometimes at the very start, it trees or takes to its rock den, where it is safe from the dogs; but if no such protection offers there is little hope for the fox. Even over rocks and in the brush I have seen the hounds catch one in a 200-yard dash. With a good start,

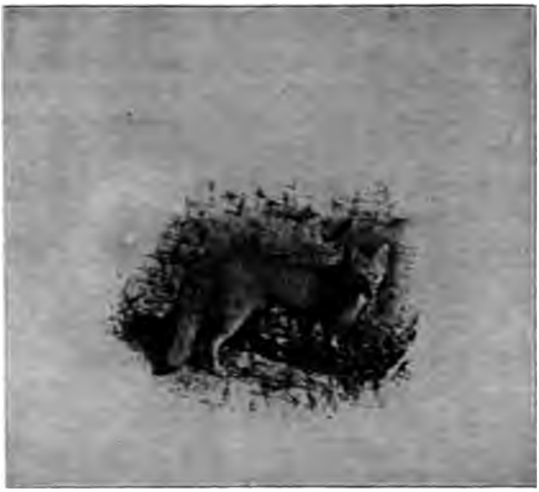

FIG. 21.—Gray fox (*Urocyon c. scotti*) in trap, Langtry, Texas.
(Photographed by Oberholser.)

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[a] The original label on the type of *Urocyon c. texensis* reads: "Rio Bravo and San Pedro. 1851. A. Schott." As is well known, Rio Bravo is synonymous with Rio Grande, and at that time the Devils River was commonly known as the San Pedro. (See Baird's Mammals of N. Am., p. 713, and Pacific R. R. Rept., Vol. I, p. 110. Also see query after Eagle Pass in Mammals, Mex. Boundary Survey, Vol. II, pt. 2, p. 17.) This seems to necessitate changing the type locality of *texensis* from 'near Eagle Pass' to the junction of the Devils River with the Rio Grande, which, however, has no important bearing on the validity of the species. In comparing the type of *texensis* and other specimens from near the mouth of Devils River, Painted Caves, Langtry, San Diego, and the Davis Mountains, in western Texas, with the type of *scotti* and with specimens from all around the type locality—near Tucson, Fort Huachuca, Fort Bowie, Chiricahua Mountains, and Fort Verde—I am unable to find any constant difference, either cranial or external, on which to recognize *texensis*.

however, one will lead the hounds a long chase over the roughest ground it can find, and if it does not make the mistake of climbing tree, instead of taking to the rocks, it is pretty safe. Strange as it may seem, these foxes go up the trunk of a tree with almost cat-like ease. I have found them looking down at the dogs from 20 to 40 feet p in the branches of nut pines and live oaks, and have known of their limbing a yellow pine (*Pinus ponderosa*) where 20 feet of straight runk over a foot in diameter intervened between the ground and he first branch. More often they take to a live oak or juniper, where the lower branches can be reached at a bound, and then, quirrel-like, hide in the swaying topmost branches. On the approach of the hunter they become anxious and seem to doubt the security of their position, sometimes making a flying leap to the ground. Stones and clubs will usually dislodge them from the tree top, but as they still have a good chance to escape the dogs and take to the rocks, it is a common and heartless practice to shoot them so as to break a leg and make escape impossible.

With his smaller but laterally flattened tail the gray fox certainly equals, if he does not surpass, the red fox in quickness of motion and skill at dodging the dogs. If uninjured, he will often strike the ground in the midst of the hounds and escape by a few quick bounds to right and left. Apparently it is only his small size that puts him at a disadvantage in a test of speed with the hounds or with his larger cousin, the red fox.

In choice of food the gray foxes are almost as omnivorous as the coon. Various fruits form the bulk of their food in summer and part of it in winter, while a great variety of small game, beetles, grasshoppers, maggots, mammals, birds, and some poultry fall a prey to them during the year. In June they were feeding extensively on berries of *Zizyphus obtusifolia* and *Adelia angustifolia* along the Rio Grande near Boquillas, while around the Davis Mountains in early August they were feeding mainly on the ripe fruit of *Opuntia engelmanni*. In December in the Davis Mountains and in September in the Guadalupe Mountains they were eating the sweet pulpy berries of *Juniperus pachyphlaea*, which grow in great abundance in these ranges and in the Chisos Mountains. Mice, wood rats, ground squirrels, rabbits, and various other small rodents are eaten when obtainable, and, much to our annoyance, are often taken from our traps or carried away, trap and all. At Langtry, Gaut examined several stomachs, and in one found part of a mocking bird and in another a *Perognathus*. At most of the ranches there are enough dogs to keep the foxes at a respectful distance from the poultry; but they have a keen relish for chickens, and are often complained of in vigorous terms. Without data for positive statements it seems probable that the good done in destroying small rodents equals, if it does not exceed, the mischief done among poultry.

As a game animal this fox is holding its ground better than many more important species, and even from the sportsman's point of view needs little protection. The skin is of so little value for fur that it is rarely saved when the fox is killed.

Urocyon cinereoargenteus floridanus Rhoads. Florida Gray Fox.

A nearly adult male gray fox from the Big Thicket, near Sour Lake, Tex., agrees with the Florida specimens in dark color, dusky legs, feet, and face, and in most of the cranial characters. The shorter, heavier muzzle is evidently due to slight immaturity. A flat skin from Tarkington Prairie is less dusky, and while probably shading toward *scotti*, more nearly resembles *ocythous*. A skull in the National Museum from Washington County, a little farther west, also shows some of the characters of *ocythous*, but is not typical of any form. While I have no hesitation in referring the Big Thicket *Urocyon* to *floridanus*, it is probable that this is not the only form inhabiting the eastern part of the State. Before final conclusions can be reached more specimens are needed, especially from farther north.

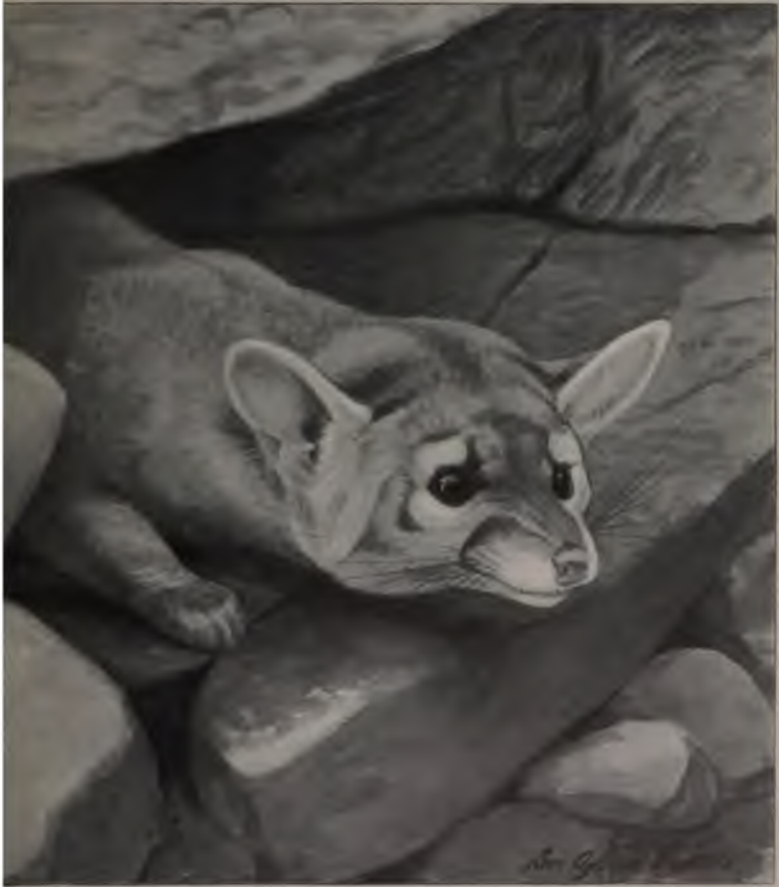
To show how generally the gray fox is distributed over eastern Texas the following localities are given from which it is reported as more or less common: Henrietta, Gainesville, Arthur, Texarkana, Waskom, Rockland, Jasper, Sour Lake, Tarkington Prairie, Evergreen, Hempstead, Matagorda, Washington, Antioch, and Long Lake. Those from Rockport and Brazos are likely to be nearer to *scotti*. My information in regard to the habits of the animal in this region has been received mainly from residents, who say that the foxes keep in the brush and timber, especially along the river bottoms, where the thickest growth is found. They are said to climb trees, and complaints of their killing poultry are more frequent than in the more open country farther west.

Near Sour Lake Gaut reports them as found mainly in the pine woods at the edge of the thicket, but as occasionally straying down into the densest part of the thicket, where he caught one on Blac Creek, near Mike Griffin's place. The stomach of this individu contained a mass of crayfish.

Bassariscus astutus flavus Rhoads. Civet Cat; Cacomistle.

The civet cat is common all over Texas except the open plain country of the western half from Brownsville, Corpus Christi, Seguin Austin, Brownwood, and Grady westward. It has been reported ea to Matagorda County, near the coast, and a specimen in the U. S. National Museum is labeled "Red River." One from Grady, Fish

PLATE XVI.



CIVET CAT; BASSARISCUS (BASSARISCUS ASTUTUS FLAVUS).

[illegible] seems to be the northernmost authentic record for the State, [illegible] species undoubtedly continues along the canyons and cliffs of [illegible] edge of the Staked Plains to the Red and Canadian rivers.[a]

[illegible] preeminently inhabitants of rocks, cliffs, and canyon [illegible] cats are common over the chaparral, mesquite, and cactus [illegible] southern Texas down to the very coast, a peculiarity of [illegible] shared by a number of other mammals which find in the [illegible] cover of dense patches of cactus and tangled thickets of [illegible] ample protection and a greater abundance of small game [illegible] rocky haunts of the higher country. In habits they are [illegible] nocturnal and carnivorous. At night they prowl [illegible] edges of cliffs from cave to cave, leaving the prints of their [illegible] catlike feet in the dry dust of the darkest corners, and [illegible] themselves to a liberal share of the *Peromyscus* and *Neotoma* [illegible] the traps of careless collectors. Usually, however, the small [illegible] are extremely scarce where the civet cats are at all common, [illegible] the wise collector scatters his small traps out over the valley until [illegible] traps have cleaned the cliffs of carnivorous species.

[illegible] to their nocturnal habits and the fastness of their rock dens, [illegible] cats are rarely seen in the wild state, but when tamed they [illegible] say they make affectionate pets and are better mousers than [illegible] cat. A pair was caught in traps in one of the canyons of [illegible] Grande and the male fought and screamed [illegible] as we [illegible], but the female was quiet and gentle. Even in the traps [illegible] and brightness of their faces were wonderful. The [illegible], when directed forward, were in constant motion. The [illegible], vibrating moustache, the striking black and light face [illegible], and, most of all, the big, soft, expressive [illegible] of unusual beauty and intelligence. [illegible] when these two were caught, made [illegible] head of the male, which [illegible] little of [illegible] white reproduction

[illegible] female caught near [illegible] May [illegible] developed fetuses, which, with a litter of four young recorded by Mr. Clark from San Pedro River, would indicate small families.[a]

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[a] The range of *Bassariscus* has [illegible]
[illegible] Baird, Mammals of North [illegible]
[illegible] Museum is labeled 'Red [illegible]
[illegible] label of this spe[illegible]
[illegible] the label, but the [illegible]
[illegible] Captain Marcy [illegible]
[illegible] records *Bassar*[illegible]
[illegible] Exploration [illegible]
[illegible] Randolph B. Marcy [illegible]
[illegible] Annual Report of Wh[illegible]
[illegible] 33.)

Most of the stomachs of *Bassariscus* examined have been found to contain the bones and hair of small rodents, which make up also most of the excrement found along ledges and in caves where the animals live. Fragments of a large centipede were found in the stomach of one caught by Gordon Donald on Devils River; and in other localities they have been reported as eating fruit. At Langtry, Gaut caught several in traps baited with meat.

Taxidea taxus berlandieri Baird. Mexican Badger.

The badger is generally distributed over the western half of Texas, but apparently is unknown in the eastern part of the State. Its eastern limit corresponds, in a general way, with the eastern edge of the mesquite country. Specimens have been taken as far east as Corpus Christi, San Antonio, and Mason, and there are records from Clyde, Henrietta, and Mobeetie. A significant fact is that the badger's eastern limit of range agrees closely with the eastern limits of the prairie dog and the Mexican ground squirrel. Its abundance depends mainly on food supply, reaching a maximum on the open plains in the prairie-dog country and decreasing slightly in the southern part of the State and in the mountains and rocky country of the extreme western part. But in speaking of badgers, abundance may mean one to a square mile, while with prairie dogs it may mean 10,000 to a square mile.

When food is scarce the badgers become great wanderers. Their short legs are fully compensated by their unusual strength and by their capacity for digging and fighting, that enable them to escape from most enemies. But with such abundance of food as is found in a populous prairie dog town, they waste little time in travel. They become fat and lazy; but as food grows scarce they start off again on their travels, sinking a house in the earth wherever sleeping time overtakes them.

The badger feeds mainly on small rodents, varied with grasshoppers, beetles, scorpions, lizards, or some larger animal found dead. It is accused of killing poultry, but the accusation is so rarely substantiated that it may well be ignored. Pocket gophers, kangaroo rats, wood rats, and various kinds of mice are always acceptable, but the badger lives mainly on prairie dogs and ground squirrels, which fall an easy prey. He often digs a dozen holes along the interminable tunnel of a pocket gopher and then gives up in disgust, but a fat spermophile or prairie dog at the bottom of its simple burrow is entirely at his disposal, nor does he have much trouble in digging it

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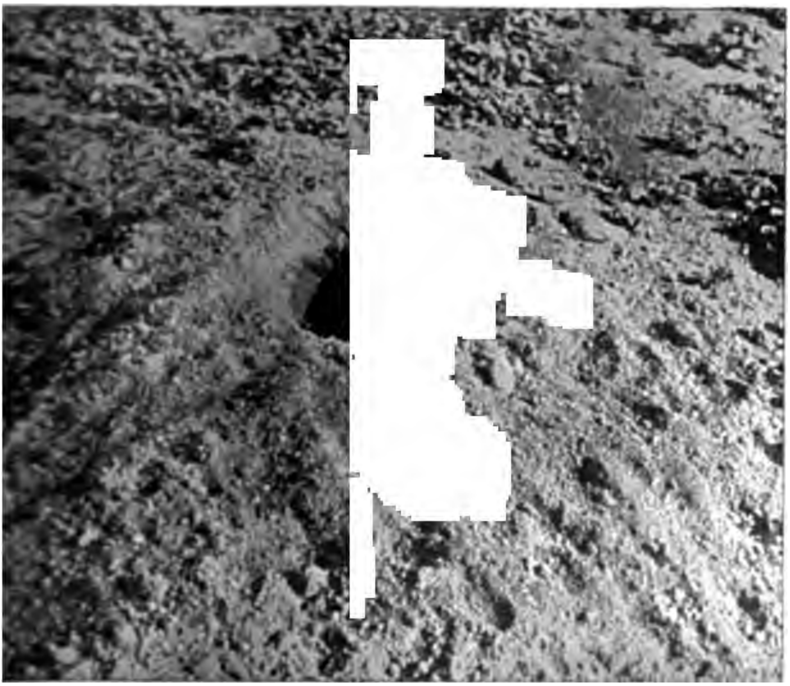
[a] Baird, Mammals of North America, p. 147, 1857.

A few minutes' work with his powerful claws will unearth the [illegible] while by merely enlarging the prairie-dog hole about [illegible] diameters he enters its deepest chambers and is sure of a good [illegible] meal at the end. On a ranch in the Pecos Valley I found a [illegible] an alfalfa field that had been overrun with prairie [illegible] morning there was at least one new hole that he had [illegible] while he may have secured two or three prairie dogs [illegible] of the burrows he was evidently destroying at least one a [illegible] badger was needed for a specimen, and at the earnest [illegible] of the ranch people, who were afraid he would kill their



[illegible] — Prairie-dog burrow [illegible]

I finally shot him [illegible] upper. He had [illegible] the day before [illegible] part of [illegible] [illegible] were afraid that [illegible] digging in the [illegible] alfalfa was rendered [illegible] prairie dogs. [illegible] convince the owner that [illegible] worth $100 to them they only laughed. Some of the ranchmen, however, appreciate the services of the animal, but even then the temptation to try a shot at one at long range or to let the dogs catch one for a fight is often too great to be resisted. Dead badgers are frequently seen by the roadside with smashed skulls or bullet holes through them, and this most often in the heart of the prairie-dog country. When taken to task for their folly in destroying these valuable animals the ranchmen have usually stoutly denied the charge, saying that most of them were killed by emigrants and other 'tenderfeet.'

The cowboys, however, have a real grievance against the badgers, especially those who have been thrown from running horses that had inadvertently stepped in old and half-concealed holes. Such accidents are by no means rare, and sometimes they are fatal to both horse and rider. It is hardly surprising, therefore, that the cowboys look upon the badger as a legitimate target for their six-shooters. In a prairie-dog country, however, this is not a fair excuse, for prairie-dog holes are just as dangerous, and each badger helps to reduce the total number of pitfalls.

The rapid increase in the abundance of prairie dogs in certain parts of the State and their constant extension of range is unquestionably due in great measure, if not mainly, to the destruction of badgers. It seems unaccountable that the intelligent observations of ranch people should not result in a strong sentiment in favor of protecting badgers, but it must be remembered that without the support of protective laws nothing can be done to prevent the destruction of the animals by uninterested and irresponsible people.

Ursus americanus Pallas. Black Bear; Cinnamon Bear.[a]

Specimens of the black bears collected in the Wichita Mountains, Oklahoma, prove to be *americanus*, and the bears reported from Mobeetie and near Washburn were undoubtedly the same. Others reported farther south from west of Austin and even to Kerrville may have been the same, also the bears from the Guadalupe Mountains, but as no specimens from these Texas localities have been seen the species can be admitted to the State list only provisionally.

At Washburn in 1892 I was told that there were a few black bears south of there in the canyon of the Prairie Dog Fork, and at Mobeetie in 1901 Oberholser reported them as "formerly common, now extinct." In 1902 Oberholser obtained a rather indefinite report at Austin that "a few bears were still to be found in the rough country west of there," and the same year at Kerrville I was told that bears were becoming very scarce, but that one had been killed the previous year only 7 miles from there.

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[a] As is well known, the black and cinnamon bears are merely dichromatic forms, or color phases of the same species, one cub of a litter often being black and another brown.

Ursus americanus amblyceps Baird. New Mexico Black Bear.

Black bears are still found in the timbered mountains of western Texas, where in a few restricted areas they are fairly common. A few specimens examined from the Davis and Chisos mountains can best be referred to *amblyceps*, but there are no specimens from the Guadalupe Mountains or from middle Texas to show where this form gives place to *americanus* on the north or to *luteolus* of the eastern part of the State. The records from Kerrville, west of Austin, Prairie Dog Fork, (near Washburn), and Mobeetie I am inclined to refer provisionally to *americanus*.

In July of 1902 a young black bear was caught by the section men on the railroad near Comstock, and a few were reported from the Pecos Canyon and vicinity. Bears were formerly abundant in this region, but apparently no specimen has been preserved to show what form ranged in the Pecos, Devils River, and Rio Grande country. On Onion Creek, 30 miles south of Marfa, in January, 1890, I picked up a skull from one of three bears killed near there in 1887. In June of 1901 black bears were common in the upper canyons of the Chisos Mountains, where fresh tracks of old and young were frequently seen and where there was an abundance of old 'sign' and turned-over stones. The old excrement was made up largely of acorns, juniper berries, and pine nuts, while the seeds of cactus fruit were noticed in the fresher deposits.

In the Davis Mountains black bears hold their own surprisingly well against unusual odds. In July, 1901, I found abundant 'sign,' fresh tracks, and turned-over stones along the crest of the higher ridges on the east slope of Mount Livermore, and again in August, 1902, found 'sign' equally abundant in the canyons on the west slopes. In following up a deep canyon west of the main peak on August 13 after a heavy rain of the previous day, I saw fresh tracks of bears of at least three different sizes—cubs, yearlings, and adults—and found numerous little diggings in the black mellow soil where roots or beetles had been unearthed, and many stones freshly turned over for the ants and beetles beneath them. In a side gulch a large buckthorn bush (*Rhamnus purshiana*) had been freshly torn up and half stripped of its ripening berries, while close by was a lot of fresh bear 'sign,' made up entirely of the skins and seeds of these berries. In other places on the east slope I found fresh 'sign,' composed mainly of the sugary berries of the checker-barked juniper (*J. pachyphlæa*),' and some that was older, largely composed of acorn shells.

In the southern part of the Guadalupe Mountains, on the upper slopes of almost inaccessible canyons, black and brown bears were common in 1901. In the head of McKittrick Canyon they had well-worn trails leading to and from their feeding grounds on the oak and juniper ridges and down the canyon to the upper water holes. In places along the sides of narrow, bowlder-strewn gulches the trails were series of big, deep tracks, where for ages each bear had stepped in the footprints of his predecessor. On the open slopes the trails spread out and were lost. On some of these slopes almost every loose stone had been turned over by bears in their search for insects, but at the time of my visit, in August, they were feeding mainly on the sweet acorns of several species of shin oak, berries of the checker-barked juniper, and, to a less extent, berries of *Berberis fremonti*. Some of the previous year's excrement contained shells of pine nuts (*Pinus edulis*), but this was the off year, when the nut pines did not bear.

Near one of the trails in the head of Dog Canyon in the Gaudalupe Mountains a Douglas spruce a foot in diameter had served for many years as a gnawing tree, while farther up the gulch a larger yellow pine was well blazed and deeply scarred by many old and a few new gashes of powerful teeth. In the Davis Mountains, on the ridge just north of Livermore, a yellow pine a foot and a half through had served as a bear register for apparently ten or twenty years. It was deeply scored on all sides from 4 to 6 feet from the ground, but on one side from 5 to 6 feet up, the bark had long been cut away and the dry weathered wood was splintered and gashed with deep grooves of various ages. Two fresh sets of tooth prints showed on opposite sides of the tree near the top of the ring, and one little bear had lately tried his teeth in the green bark about 4 feet from the ground. At the head of a gulch on the east side of Limpia Creek stood another big yellow pine that had been similarly treated, and on it, as on the others, the upper limit of reach was about 6 feet from the ground. Apparently the bear at each visit to one of these register trees had given but a single bite, leaving the marks of an opposing pair of canines.

In January of 1890 I learned that ten or twelve bears had been killed in the Davis Mountains the fall before, and the annual bear hunt of the ranchmen has become as firmly established an institution there as the annual camp meeting. In November a large crowd gathers with camp wagons, hounds, and saddle horses for a week's bear hunting. In 1900 ten bears were killed by the party, and in 1902 four were killed. Others are killed each year by local hunters.

At present the black bears do no serious damage to stock, and it is greatly to be hoped that their numbers will not be materially reduced.

Ursus luteolus Griffith. Louisiana Bear.

The Louisiana bear formerly ranged over most of eastern Texas, and still is found in considerable numbers in the more extensive and thickets. Skulls examined from Kountze,[a] Sour Lake, gton, and Wharton have the long, low brain case and very molars characterizing the species, while the skins are indistin- ble from those of *americanus* in the black phase.

following reports of field naturalists for 1902 from scattered will give an idea of the present status of the bears over Texas.

[illegible] Now very rare; one killed a few years ago.

[illegible] Formerly common; now very rare.

[illegible] Very scarce; one killed near here a few years ago.

[illegible] Formerly common; now extinct.

[illegible] Now very rare or quite extinct.

[illegible] A few still found in the 'big thicket' 15 miles south of

[illegible] A few still found in the forest northwest of here.

[illegible] Formerly common along the Brazos; now extinct.

[illegible] Formerly common; now rare or extinct.

Lake: Still common in the swamps near here; a few killed year. An old one and two cubs seen during July.

Richmond in 1899 I was informed that bears were still fairly the timbered bottoms along the Bernard River, 18 miles southwest, where in the fall one old trapper made a business of them. At Seguin, in 1904, they were [illegible] to have [illegible] years ago, though formerly common.

following reports, made in 1900 by Oberholser, probably [illegible] this species:

[illegible] Bears are still found on the [illegible]

Diego. One was seen a few years ago [illegible]

[illegible] A few are still found in the [illegible]

Wharton in November, 1904, I [illegible] year by a negro who [illegible] near there. Mr. W. O. [illegible] several bears were living in the [illegible] of them later in the [illegible] Mr. [illegible] an apiary with a large [illegible] the dense woods [illegible] Wharton, and the [illegible] through [illegible] he has killed [illegible] Some of the [illegible] others in the [illegible] Mr. [illegible] and two companions who were watching for it in the bee stand. When the men approached the bear after he was located, they could hear him whining and sniffling as if the bees were making it hot for him. This probably accounts for his letting them come near enough by moonlight for a fatal shot. This bee stand was about 3 miles from town and back from any settlement or ranch, and the bear had been feasting on honey for several nights before the mischief was discovered. Mr. Victor says about fifty swarms were destroyed, the hives turned over, part of the honey scooped out, and the bees scattered. In many cases the bear apparently became enraged at the stings and smashed the hives in retaliation. A photograph of this bear, taken the following morning, shows him stretched out among the overturned hives and gives some idea of the mischief he had done.

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[a] Biological Survey [illegible] Mr. [illegible]

[b] One skull of this species [illegible]

Mr. Victor says the bears in that region 'den up' for a little while during the coldest part of winter, or at least keep quiet in the densest thickets. He says they are invariably black, and he thinks the nose also is black.

In November, 1904, an old bear hunter, Ab Carter, living on the west edge of Tarkington Prairie, in Liberty County, told me that there were no bears at that time in Liberty County west of the Trinity River, but the active part taken by Mr. Carter in exterminating the bears in that locality makes his statements of peculiar interest. Forty-nine years ago he was born on the ranch he now owns, and his principal occupation, like that of his father, has been keeping hogs and killing bears. To a man with several hundred hogs running in the woods, bear killing was the most important part of the season's work, but it was not until about 1883 that the extermination of the bears began in earnest. At that time Mr. Carter and a neighbor each got a pack of good bear hounds and in the following two years they killed 182 bears, mainly within a radius of 10 miles from the ranches. This reduced the number of bears so that later not more than ten to twenty were killed annually up to 1900, when Mr. Carter killed the last two of the vicinity. Two years ago he killed the last of his bear dogs, and now keeps only hog and wolf dogs, while his hogs eat acorns in safety over 100 square miles of magnificent forest and dense thicket.

The number of hogs killed in a year could be only approximately estimated, but Mr. Carter thinks the bears sometimes got nearly half of the pigs and many of the hogs. Pigs were their favorite prey, and were easily caught, but the bears took anything they could get. One large 4-year-old boar was killed and partly eaten only a mile from the house.

As soon as acorns began to fall the bears would feed on them and let the hogs alone for a while, but during spring and summer pork was their principal food. The first berry to ripen in summer, Mr. Carter says, is on the 'grandaddy graybeard' bush (apparently *Ame-*

), of which the bears are very fond. Blackberries and huck-
s are abundant summer food for bears. Later the sour gum
sylvatica) is a favorite food, and nearly every sour-gum tree
roods has its top branches bent and twisted and its bark well

Carter went with me to an old pine 'measuring tree' in the
hat he said had been bitten deep into the wood about as high
e could reach, but when we found the tree it was only a
stump. Fire had destroyed all trace of the bear marks.
r small pine that we found had grown well out around the
s that still showed plainly in the dead wood. Mr. Carter
ress trees are sometimes bitten in the same way by bears, but
monly than pines.

e Big Thicket of Hardin County black bears were common
r parts of the thicket in December, 1904, but not so abundant
were a few years ago. I had no trouble in starting one
every day, but could not get a pack of dogs that would hold
I could get to it. I had five good bear hounds, but each of
ral bears that we started escaped. The bears in this region
ree for dogs, and unless the dogs keep one fighting on the
he travels faster than a man can run through the jungle of
nes, brush, and vines. Horses are useless in the thicket.

e hunting I found numerous bear beds and old and fresh
ome composed of acorns, some of sour gum and other berries.
o saw half chewed acorns where the bears had been feeding.
summer the bears feed extensively on pigs belonging to the
, but in December both pigs and bears were rapidly fattening
bundant acorn crop.

veral places in the heart of the Thicket I found cypress trees
by the bears as high as they could reach, 6 to 7 feet from the
, and I photographed two of these trees. One, which was
foot in diameter, had been bitten lately and at different times
ly for at least eight or ten years. Several large spots of
ere dead and bare of bark and full of old tooth prints. The
ne, over 2 feet in diameter, had been bitten for a longer time,
y fifty years, and the old dead wood was sunken 4 or 5
leep in the surrounding growth. The fresher bites were on
ts and some were made apparently the day before, as fresh
d been rubbed against the trunk as high up as 4 feet. One old
ne about 14 inches in diameter had been well bitten at the
right, but in this region cypress seems to be the favorite biting
'measuring tree,' as called by the hunters. Several magnolia
owed deep claw marks in the smooth, gray bark, and the
ark of the sour gum is often clawed extensively, although
ts *are indistinct*. *The* bears are said to feed to some extent

on magnolia berries and very extensively on the berries of the sour gum.

I have inquired of many hunters and find none who have ever seen a brown bear in this region. The nose is said to be brown in some and entirely black in others. The large old male, of which I secured the skull and incomplete skin, was said to have had a brown nose, as did the perfect skin of the female sent with it. Dan Griffin, who killed it, says it was the largest bear he ever saw. He thinks it would have weighed 400 pounds, although poor, and says that two men while skinning it had hard work to turn it over.

Ursus horribilis horriæus Baird. Sonora Grizzly.

The only specimen of grizzly bear that I have seen or heard of from Texas was killed in the Davis Mountains in October, 1890, by C. O. Finley and John Z. Means. The skull, which Mr. Finley has kindly sent me for comparison, proves to be that of a large and very old male of the Sonora grizzly, agreeing in all essential characters with Baird's type of *horriæus* from southwestern New Mexico. The measurements of the skull are: Greatest length, 370; basal length, 310; zygomatic breadth, 220; mastoid breadth, 157; interorbital breadth, 71; postorbital breadth, 69. The claws on the front feet, Mr. Finley says, were about 3½ inches long, and the color of the bear was brown with gray tips to the hairs. Its weight was estimated at 1,100 pounds, 'if it had been fat.' Mr. Finley says that this bear had killed a cow and eaten most of it in a gulch near the head of Limpia Creek, where the dogs took the trail. Out of a pack of fifty-two hounds only a few would follow the trail, although most of them were used to hunting black bear. These few followed rather reluctantly, and after a run of about 5 miles over rough country stopped the bear, which killed one of them before it was quieted by the rifles of Finley and Means. It took four men to put the skin, with head and feet attached, upon a horse for the return to camp.

Nasua narica yucatanica[a] Allen. Nasua; Coati.

A specimen of this long-nosed, long-tailed, coon-like animal in the National Museum, collected in 1877 at Brownsville by the late Dr. J. C. Merrill, furnishes apparently the only record for the State. As nasuas occur over most of Mexico up to near the border of the United States, other records along the Rio Grande may be expected.

Procyon lotor (Linn.). Raccoon; Coon.

The raccoon of eastern Texas, as represented by specimens from the coast region as far west as Matagorda and in the interior from Texrkana west to Kerrville and Mason, differs but little from typical *otor* of the northeastern United States. The slightly larger size, vider muzzle, and usually heavier dentition show a tendency toward *nexicanus*, into which it grades to the west. The high frontals of pecimens from the coast marshes of southeastern Texas suggest an pproach to *elucus*, the Florida form, but in the light of the present naterial these coast specimens can best be referred to *lotor*.

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[a] Dr. J. A. Allen, in Bul. Am. Mus. Nat. Hist., XX, 53, 1904, identifies the Brownsville specimen as *Nasua narica yucatanica* Allen; it is possible, therefore, that this specimen may have been an imported animal that escaped from captivity.

Coons are abundant along the margins of streams, lakes, and bays, long the coast, in marshes, or around water holes, adapting their abits to almost any condition save that of dryness. In the timbered ountry hollow trees, hollow logs, cavities under old logs, or upturned roots provide them temporary homes in which to spend the day, and on the great salt marshes of the coast country masses of fallen grass and rushes provide dark cover, or hollow banks and windrows of drift stuff afford safe retreats, while the broken walls of rocky canyons and gulches toward the headwaters of the streams furnish the favorite, because the safest, dens. It is not uncommon for coons to leave the stream where they have been hunting and travel half a mile or a mile to dens in a cliff, though otherwise they are rarely found so far from water. They are mainly nocturnal, and every morning their unmistakable plantigrade tracks mark the shores of the streams, following the trails, logs, or mud flats, now in, now out of the water, often disappearing where the animals swam from point to point or from one side to the other of the stream in search of food. Often the coons follow the same line of travel again and again, until well-worn trails are formed along the margins of the streams or through the marsh grass. Along these trails scattered remains of food tell half the story of the coon's life. In places along the Guadalupe River, in Kerr County, almost every little point and island has its pile of mussel shells from which the mussels have been eaten, and every morning a few shells freshly scooped out are found on the piles until sometimes a bushel is accumulated. On the coast marshes the shells of crawfish are found scattered along the coon trails, while the excrement deposited here and there in well-chosen spots is made up largely of the indigestible parts of crustaceans mixed with a few scales and bones of fish and occasional traces of frogs and small mammals. As these marshes swarm with crawfish and small crabs, the coons have a perennial feast and naturally become numerous. On Matagorda Peninsula Lloyd reported them feeding on oysters as well as crabs and crawfish, and in the stomach of one caught near the mouth of the Colorado River he reported finding a meadow lark. In their selection of food coons are quite as omnivorous as bears, seeming to relish almost any kind of flesh, fruit, grain, nuts, and acorns. At Brazos they were reported by B. H. Dutcher as feeding on melons.

Their nightly raids on fields of green corn are too well known to need comment, and small fields of corn planted in or near the woods are sometimes almost destroyed, the ears being torn open and the corn eaten from the cob from the time of the early milk stage until ripe, and even after being cut and shocked.

In the Big Thicket coons are numerous along every stream and bayou, as shown by fresh tracks along roads and trails and in the muddy margins of ponds and water ways, and by skins drying under the sheds of almost every ranch. Their fur is the principal catch of most of the trappers and their abundance makes trapping fairly profitable in this region. During November and December they were feeding mainly on acorns, but were still eating crawfish, while the old shells of mussels, including the enormous pearl-bearing species (*Quadrula heros*) and the smaller thick-shelled *Quadrula forsheyi*, piled here and there along the banks of bayous, apparently marked the remains of summer feasts.

While watching for fox squirrels one morning in the heavily timbered bottoms I heard a scratching sound from an old cypress in the edge of the swamp near by, followed by a loud splash. A young coon less than half grown had fallen from the tree into the water. At the sound the old coon and two more young ones came out of a hollow some 30 feet up in the trunk and climbed down to near the bottom of the tree. They came down the tree slowly but steadily, head first, as a squirrel would have done, with the hind feet reversed and slightly divergent. When the old coon saw the young one climb out of the water upon the tree trunk she turned about and ascended the trunk, followed by the three young. The one that had fallen, besides being very wet, was slightly hurt, and climbed with difficulty. When halfway up he stopped on a limb to rest and began whimpering and crying. The mother had already reached the hole, but on hearing his cries turned about and climbed down to him. Taking a good hold of the back of his neck and placing him between her fore legs so that he, too, could climb she marched him up the tree and into the hollow.

Procyon lotor mexicanus Baird. Mexican Raccoon.

Raccoons are common along every stream in Texas, and especially common along the coast and on the islands. Specimens from the Rio Grande, Pecos, and Devils River country are large and pale; they have a long tail and the more quadrate molars of *mexicanus*, to which subspecies they are referred, although differing in having the narrower basioccipital and yellow nape of *lotor*.[a]

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[a] It has been customary to refer specimens from western Texas to *hernandezi*, but a number of specimens of that species from the type region in Mexico, collected by Nelson and Goldman, prove to be quite different from the Texas animal.

he northern part of the State the range of *mexicanus* is partly
from that of the smaller, darker coon of eastern Texas by the
; but near the coast, where there is no break in the ranges, only
itrary division can be made between the two forms. Specimens
as far east as Corpus Christi can safely be referred to *mexicanus*
hers from as far west as Matagorda to *lotor*, while specimens
n, from Port Lavaca and Aransas County, can be referred as
one as the other. Assuming, as seems necessary, that Baird's
ribing and correctly naming "*Procyon lotor* variete mexicaine"
Hilaire[*] fixes the type locality at Mazatlan, Mexico, the name
nus becomes available for the coon of western Texas, which,
not typical, is certainly nearer to this form in general char-
as well as in geographic position, than to any other.

western Texas coons are closely restricted to the streams, and
ently are rare over the wide intervals of dry desert country
n. Along the Rio Grande, Pecos, and Devils River valleys
re especially abundant, and their dens are almost invariably
l in the broken walls of cliffs and canyons. In the low country
l the coast of southern Texas, where dense chaparral, cactus
n, and the tall grass of the salt marshes offer ample shelter and
s are not infrequent, they have a more continuous distribution.
Corpus Christi to Brownsville their tracks were seen along the
of every stream and pond and were especially numerous near
ast, where the animals apparently lived on the little fiddler
(*Gelasimus pugilator?*), always found in abundance on the
ndy soil. Lloyd reported hackberries (probably *Momesia pal-*
in the stomach of one caught at Corpus Christi. In the Pecos
evils River canyons the heavy shells of one of the pearl-bearing
ls (*Lampsilis berlandieri*) are often found in piles along the
of the streams, but the ripe fruits of the prickly pear (*Opuntia*
nnoni) and of the black persimmon (*Brayodendron texanum*)
heir principal food in July and August. The sweet pods of
ite were also eaten, and apparently some of the insipid berries
yphus, *Condalia*, *Adelia*, *Lycium*, and *Momisia*.

(canadensis?) (Schreber). Otter.

rs are not uncommon in the streams of eastern Texas, but,
unable to procure a specimen from any part of the State, I can
provisionally refer the species to *canadensis*. The only speci
hat throws any light on the question is a fine old male collected
llulah, Madison County, in northeastern Louisiana, by W. E.
s and N. Hollister, which agrees in most characters with *cana-*
and shows no tendency toward intergradation with the Florida
L. c. vaga.

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[*] *Voyage de la Venus*, Zoologie, p. 125, 1855.

In the Big Thicket of Liberty and Hardin counties otters are common, and a few are caught each year by the local trappers. During low water the black pools of the half-dry bayous, swarming with landlocked fish, are their favorite haunts. Oberholser obtained reports of otters at Mobeetie and along the Red River at Texarkana, and along the Neches and San Jacinto rivers near Beaumont and Conroe. Lloyd reported them from Palacio Creek, Matagorda County, and John M. Priour writes that they are found on the Colorado River in the region of Austin. None of our field men have ever heard of them along the Rio Grande or Pecos rivers, however, while several old trappers, long familiar with the Rio Grande, Pecos, and Devils rivers, have assured me that otters were never found along these streams. In addition to this evidence, Mr. W. H. Dodd, of Langtry, has told me that for many years in buying fur of the local trappers no skins or even reports of otters had come to his notice in that region. Along Big Cypress Bayou, below Jefferson, in northeastern Texas, Mr. Richard Crane told me in 1902 that otters were fairly common, and in fifteen years' hunting and fishing along this stream he had killed eight or ten, most of which he shot. One that came up near his boat and then dived, leaving its tail temptingly above water for a second, he caught by the tail, whereupon it promptly curled up and severely bit his legs and hands before he could kill it. He says $50 would not tempt him to catch another otter by the tail.

Lutreola lutreocephala (Harlan). Large Brown Mink; Southeastern Mink.

Minks are common over approximately the eastern half of Texas, but apparently are unknown in the western part of the State.[a] The western limit of their range is roughly indicated by specimens from Gainesville, Brazos, and Mason, and by reports of occurrences near Austin and on the lower Guadalupe River.

I have examined specimens from Gainesville, Brazos, Mason, Navasota, Harris County, Matagorda, Tarkington Prairie, Rockland, Antioch, and Texarkana, but find no characters, cranial or external, by which to separate them from typical *lutreocephala* from Maryland and the District of Columbia.

Along most of the streams and bayous of the timbered country of eastern Texas, minks are so common as to form an important item in the catch of the local trappers. In fall and winter a few of their skins are usually found among the more numerous coon, opossum, and kunk skins at trappers' camps or cabins, or in general merchandise or ur stores of the town. While usually closely associated with stream ourses, where much of their food consists of fish, frogs, crustaceans, irds, and mice, minks are perfectly at home in the dry parts of oods and swamp, and even on the open prairie. At Navasota I aught one in woods near the river and another in a trap set in a ut bank gulch in the middle of a wide field. Both were attracted y bodies of birds that had been shot for specimens, and while in the raps had gorged themselves with the bait. At Tarkington Prairie ninks are said to be much less common in the timber than on the open prairie, where myriads of birds roost at night in the long prairie grass, and crawfish chimneys thickly dot the margins of shallow ponds. Along the coast marshes the minks follow the shores of bayous and ditches, where their tracks usually may be found in the mud and sand, or range back over the wide expanse of marsh and prairie, where tall grass and drift heaps furnish ample cover. Over these marshes they feed extensively on crawfish and minnows, as shown by their excrement. One caught by Lloyd on Matagorda Peninsula had a freshly eaten cotton rat in its stomach.

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[a] Cary obtained an indefinite report of 'mink' at Fort Stockton, in the Pecos Valley, but there is a possibility that the name may have been applied to some *other animal*.

The occasional losses from the raids of minks on the poultry yard in most cases can be prevented by a little care on the part of the farmer in providing roosting places out of reach of the prowling minks, if necessary, with tin-covered uprights. Minks are good climbers, and will sometimes climb to the top of a tall tree to escape the dogs, but they seem to hunt almost entirely on the ground. An ordinary poultry fence with fine wire mesh affords perfect protection, not only from minks, but from many other troublesome 'varmints.' The value of the mink's fur makes the animal of considerable economic importance, especially as it has proved its ability to hold its own in thickly settled districts. Its value as a destroyer of small rodents compensates in part, if not fully, for its depredations.

Putorius nigripes Aud. and Bach. Black-footed Ferret.

The black-footed ferret has been reported from a number of localities in the prairie-dog country of Texas east and south of the Staked Plains. A very large weasel, described by B. H. Dutcher in 1893 at Stanton, may or may not have been of this species. Merritt Cary learned of one that was killed in 1894 at Seymour. J. A. Loring found an almost perfect skull of a fine adult at Childress on the house of a wood rat. A flat skin in the U. S. National Museum, labeled "Gainesville, Texas," probably came from some point west of there, as it is merely a rough hunter's skin, evidently not prepared by G. H. Ragsdale, whose name is on the label. If this were a bona fide record for Gainesville it would be the first from any point far ut of the range of the prairie dog.

In September, 1902, Cary writes:

> A number of black-footed ferrets are said to have been caught at the dog town south of the Stanton stock yard in past years, and every person questioned was familiar with the animal and could give a good description of it. Doctor Vance, living just north of town, saw one about a week before I arrived there and set a rude box trap at the hole in an attempt to capture the animal alive, but without success. A Mr. Williams, living at Fort Stockton, kept for a year or more a black-footed ferret which a Mexican caught in a trap set at an old adobe house on the edge of a dog town just north of the Pecos River at Grand Falls. It was described to me as built like a mink, with dark-brown feet and a bar across the face.

At Lipscomb, in July, 1903, A. H. Howell "saw the hide of one killed there the previous summer and was told of a den of them located near First Creek."

Putorius frenatus (Lichtenstein). Bridled Weasel.

While never common, the bridled weasel seems to be generally distributed over the low country of southern Texas. There are specimens in the Biological Survey collection from Brownsville and near Hidalgo. Oberholser examined mounted specimens at San Diego, Beeville, and Port Lavaca. Lloyd reported the species from Corpus Christi, and Attwater from San Antonio.

Putorius frenatus neomexicanus Barber and Cockerell. New Mexico Bridled Weasel.

This species, so far as I know, is not positively known to occur in the State of Texas, but in the winter of 1889 I found the tracks of a weasel winding in and out of the *Dipodomys* and *Perodipus* holes in the sandy bottoms just below El Paso. A record of a weasel taken several years ago at Langtry (reported to Oberholser by W. H. Dodd, of that place) may have been of this species, and suggests a continuous range from the country of *frenatus* up the Rio Grande to the type locality of *neomexicanus* at Mesilla Valley, N. Mex.

Spilogale leucoparia Merriam. Rio Grande Spotted Skunk.

This beautiful little spotted skunk, with broad white stripes, occupies the rough country bordering the southern arm of the Staked Plains from Mason and Waring to Langtry, Comstock, and Eagle Pass and farther south into Mexico. It is probably the form occupying also the rough country east and west of the Pecos Valley. In the Davis Mountains the ranchmen report a spotted skunk as common, and say that it climbs trees as readily as a squirrel. It is often treed by the dogs at night and shot from the branches by the hunters. Under the nest of a great horned owl in the face of a cliff at the west base of the Davis Mountains I found several jaws of these little skunks in the owl pellets. Throughout most of its known range it inhabits rocky gulches, cliffs, and canyons, or the brushy bottoms usual in such places.

Spilogale interrupta (Rafinesque). Prairie Spotted Skunk.

This dark form of the spotted skunk, or spilogale, with the narrow white stripes, comes into Texas from the more northern plains, and is represented by specimens from Canadian, Gainesville, and Brazos. Beyond these localities there are no specimens to show the limits of its range in the State or to indicate whether it grades into the neighboring forms to the south. Though the little "spotted skunks," "hydrophobia cats," or "phoby cats" are reported from almost every part of Texas, even including the top of the Staked Plains, there is still much to be learned of the range and relationships of the several forms inhabiting the State.

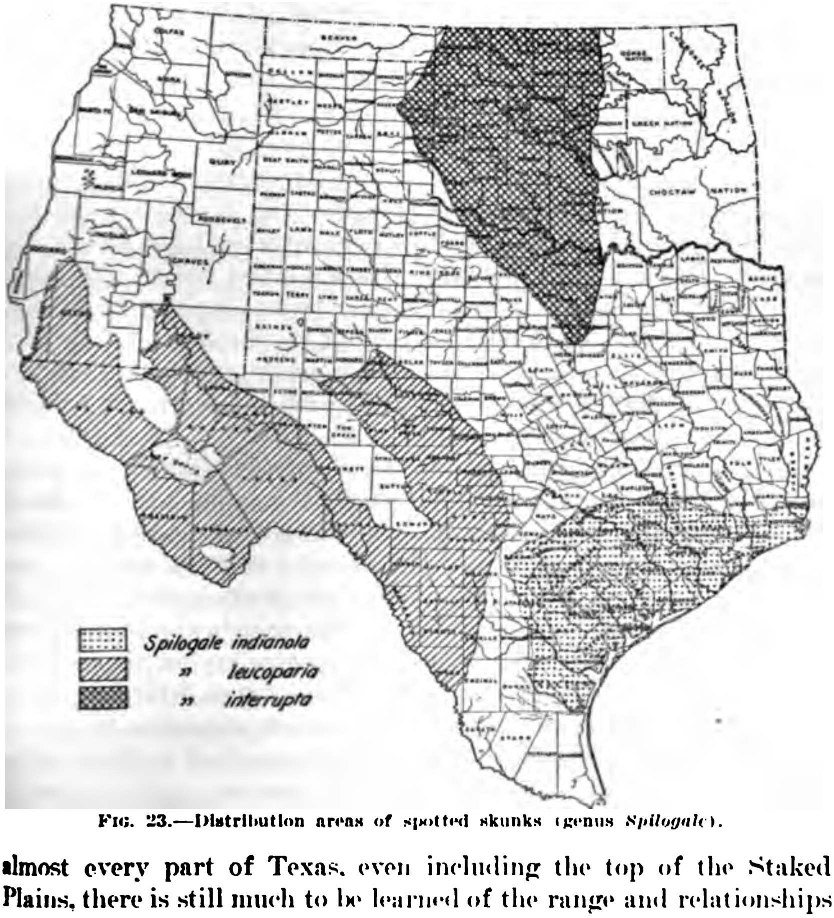

FIG. 23.—Distribution areas of spotted skunks (genus *Spilogale*).

Although, broadly speaking, plains animals, these spilogales, like most species of the genus, take advantage of any cover in the way of bushes, tall grass, stream banks, or old buildings that the country offers. In Kansas I have caught them in burrows in the sandy soil, but whether the burrows were of their own digging or borrowed from spermophiles or other burrowing mammals I could not tell. At Canadian, Tex., one was caught in a No. 0 steel trap set in an old tumbledown shed in the corner of a field and baited with the bodies of birds that had been skinned for specimens. I had with me a bottle of bisulphid of carbon for experiments on prairie dogs. Thinking to try a new experiment, I scraped a hollow about 8 inches deep in the sand, and with a stick gently loosened the trap chain and slowly drew the little skunk to the hole. He tumbled in, thinking he had escaped, and curled up in the bottom. I then poured a couple of ounces of bisulphid on a bunch of grass and threw it into the hole, and after waiting five minutes found the skunk dead and perfectly free from unpleasant odor. This method of killing any of the skunks, when it becomes necessary to trap them around buildings, can safely be recommended.

Spilogale indianola Merriam. Gulf Spotted Skunk.

This little spotted skunk inhabits the coast region of Texas from Corpus Christi to southwestern Louisiana and extends inland as far as Beeville, San Antonio, and Navasota. So far as known, it is mainly an animal of the cactus and chaparral patches of the open country. In the Big Thicket region I could get no reports of it east of Conroe, but at Navasota I found it common and caught two in traps in brushy places. At Beeville Oberholser caught one in a trap set in the runway of a wood rat. Of two specimens secured by Lloyd in Matagorda County one was taken in a group of burrows in a thicket on the prairie and the other in an old cotton gin. In the stomach of the former were found parts of a *Perognathus hispidus* and some crawfish. Near Corpus Christi I caught the animals in bunches of prickly pear and in wood-rat houses under the mesquites. At Virginia Point, on the prairie near Galveston, I shot and trapped them in the big bunches of cactus (*Opuntia engelmanni*) found here and there on the prairie. Such confidence had they in the protection of these thorny masses that one came out repeatedly, thrusting its head between the cactus blades to watch me with its keen little eyes, first at one window then at another, moving about freely among the thorns and refusing to enter its burrow even when I approached to within a few yards. Its motions were quick and alert, and its expression bright and weasel-like rather than skunk-like, which, added to its beautiful markings, made it a most attractive little animal. The burrows under the cactus and thorny huisache bushes were apparently dug by skunks, as no other burrowing animal near their size occurs there. The stomach and intestines of the specimens taken contained only shells and legs of a large brown beetle which swarmed about the houses at night. A few legs and wings of grasshoppers were found in the lower intestines of one individual.

Mephitis mesomelas Lichtenstein. Louisiana Skunk.

The Louisiana skunk is common over the whole of eastern Texas and about as far west as Wichita Falls and Matagorda Bay. Speci-

Specimens from O'Connorport are clearly intermediate between *mesomelas* and *varians*, as are also specimens from Wichita Falls. There is apparently no locality in Texas where skunks are not more or less [illegible], and the transition from *mesomelas* to *varians*, while not abrupt, seems to follow approximately the line of transition from humid forest and prairie country to semiarid mesquite plains.

Skunks are generally less common over eastern than western Texas, owing probably to the more thickly inhabited country to the eastward, to the number of dogs kept at every little farm or cabin, and to the popular superstition that all skunks convey hydrophobia and so are destroyed whenever possible. There are undoubtedly authentic cases of rabies in skunks, as well as in other animals that have been inoculated with the disease, but there is no reason to suppose that they are any more subject to it than dogs or cats nor more dangerous to human beings when they do have it. On the other hand, they are among the most useful of the predatory mammals, destroying great numbers of small rodents, grasshoppers, beetles, and larvae, and should be protected, except in rare cases of mischief. There are a few complaints of their destroying poultry, but in most cases this mischief can be easily prevented.

At Virginia Point, on the prairie opposite Galveston, I trapped a skunk one morning in a bunch of cactus and by a bungling shot allowed it to discharge its odorous fluid. Being anxious to save the skin in spite of its odor, I sat down on a patch of dry sand to skin it, and in a few minutes a black shadow passed me on the ground. Looking up I saw not less than 50 turkey buzzards and black vultures beating up the wind in a long line straight toward me. They were flying low and keenly scanning the ground. Many came within 20 feet, apparently, before seeing me, and soon I was the center, though not the object of attraction, of the constantly increasing flock. As [illegible] ended and I moved away they pounced on the carcass and soon there was nothing but the large scent gland and its odor to mark the spot. Even the bones had mostly disappeared. This is but one of many similar instances in which turkey buzzards and vultures have quickly responded to the smell of a freshly killed skunk, although they usually leave a cleanly picked skeleton [illegible] the [illegible] ground.

Mephitis mesomelas varians (Gray). Long-tailed Texas Skunk.

The long-tailed skunk ranges over western Texas from [illegible] west to El Paso and east to Rockport, San Antonio, [illegible], [illegible], Canadian, and Lipscomb, or approximately over the [illegible] regions and plains of Texas in both Upper and Lower Sonoran zones. Although generally distributed even over the top of the Staked Plains, these skunks are most abundant in the chaparral of [illegible] country, especially along bushy-bottomed, rocky walled gulches and in canyons, where to an abundance of food are added ample cover and the protection of numerous safe retreats. The sandy bottoms and dusty trails are almost invariably marked with their tiny, bear-like tracks, and they are frequently met with morning or evening racking along the trail on their way home or abroad. At night they often come into camp, and leave tracks in the ashes of the campfire or around the 'grub box,' but in years of camp life where they are common I have never know them, when unprovoked, to be discourteous or disagreeable. One morning in the Davis Mountains we noticed tracks and numerous little holes dug in search of beetles around our beds and among the frying pans and kettles. We had evidently camped on the favorite digging ground of this particular skunk and he had quietly put up with the inconvenience of our presence.

The skunks often acquire the habit of coming to camp for the discarded bodies of birds and mammals that have been skinned for specimens, but if their favorite foods—grasshoppers, cicadas, beetles, and grubworms—are abundant, it is difficult to entice them into traps with any kind of bait. Any small game that they can catch for themselves is welcome and they sometimes raid an unprotected chicken coop. I have found their stomachs filled with berries of zizyphus, and have noted the remains of cactus fruit, black persimmons, and small berries in the 'sign' along their favorite trails. But legs and shells of grasshoppers and beetles usually form the bulk of their 'sign.' One caught at Santa Tomas by Lloyd had just dined on a cotton rat, and in other places Lloyd reported them as feeding on wood rats. Occasionally they find our traps and eat the small rodents caught in them.

Conepatus mesoleucus mearnsi Merriam. Mearns Conepatus; Hog-nosed Skunk.

The white-backed or hognosed skunk is common over most of western Texas, from Kerrville, Mason, and Llano to the Rio Grande and beyond, and south to Dimmit County. Along Devils and Pecos rivers and the canyon country of the Rio Grande and in the Davis Mountains it is evidently the commonest skunk. It apparently has not been taken in the El Paso part of the Rio Grande Valley, but as it is found farther north, it undoubtedly occurs there also. Oberholser obtained a report of its rare occurrence at Austin, which is its easternmost record. Specimens reported by H. P. Attwater from San Antonio are probably of this species.[a]

The scarcity of specimens of *Conepatus* in collections is not due entirely to the scarcity of the animals. In several localities where they were common and their long-clawed tracks and peculiar diggings were abundant and fresh every morning, I utterly failed to trap them, as they would not come near any kind of bait that I could offer; but in these localities their favorite food—a large brown beetle—was abundant. Near Boquillas, in the side canyons of the Rio Grande, the mellow sandy bottoms were pitted with little funnel-shaped holes about 2 inches deep where the animals had dug out the beetles, whose round holes perforated the ground on all sides like half-inch auger holes. One of the skunks shot by moonlight early in the evening on his digging ground had already filled his stomach with these crisp juicy beetles to the number of several hundred. In skinning him the next morning I was struck with the adaptability of his long naked nose to the work of probing the beetle holes. A sniff would probably show whether the beetle was at home and worth digging for or whether the hole was occupied by a tarantula. This and two other specimens, which I failed to shoot in such a way as to break their backs and prevent the discharge of their scent gland, curled up with their last gasp and drenched their bodies from head to tail with the reeking fluid, which differs neither in quantity nor strength from that of *Mephitis*. The repetition of this act by the two individuals indicates a habit not shared with the common skunk, which to its last breath tries to avoid soiling itself in using its weapon of defense. In general the habits of *Conepatus* and *Mephitis* are very similar even to a choice of the same brush patches and gulch bottoms for foraging ground. They must frequently meet, whether on friendly terms or otherwise.

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[a] *Allen*, Mammals of Bexar County, Tex., in Bul. Am. Mus. Nat. Hist., VIII, 72, 1896.

Along Devils River in July *Conepatus* was common, but as usual was difficult to catch. One got into a trap set in a trail and another was shot by moonlight as it trotted through camp. They were feeding on beetles, grasshoppers, crickets, and the ripe fruit of the prickly pear (*Opuntia engelmanni*). Near Langtry Gaut caught an old female, March 24, which contained a single embryo that he thought would have been born a week later.

Conepatus mesoleucus telmalestes subsp. nov. Swamp Conepatus; White-backed Skunk.

Type from the Big Thicket, 7 miles northeast of Sour Lake, Tex., ♂ ad., No. 136551, U. S. Nat. Mus., Biological Survey Coll. Collected by James H. Gaut, March 17, 1905. Original No. 3485.

General characters.—Similar in general appearance to *Conepatus mesoleucus mearnsi*, skull usually slenderer, dentition lighter.

Color.—Whole upper parts and tail white, the white extending forward on forehead nearly to eyes; lower parts, sides, legs, and face black.

Skull of type elongated, with slender muzzle, narrow interorbital region and prominent mastoid processes; upper molar relatively long and narrow, upper and lower carnassials strikingly smaller than in comparable specimens of *mearnsi.*[a]

Measurements of type.—Total length, 625; tail vertebræ, 257; hind foot, 78. Of two female topotypes: Total length, 610; tail vertebræ, 265; hind foot, 67; and total length, 676; tail vertebræ, 304; hind foot, 74.

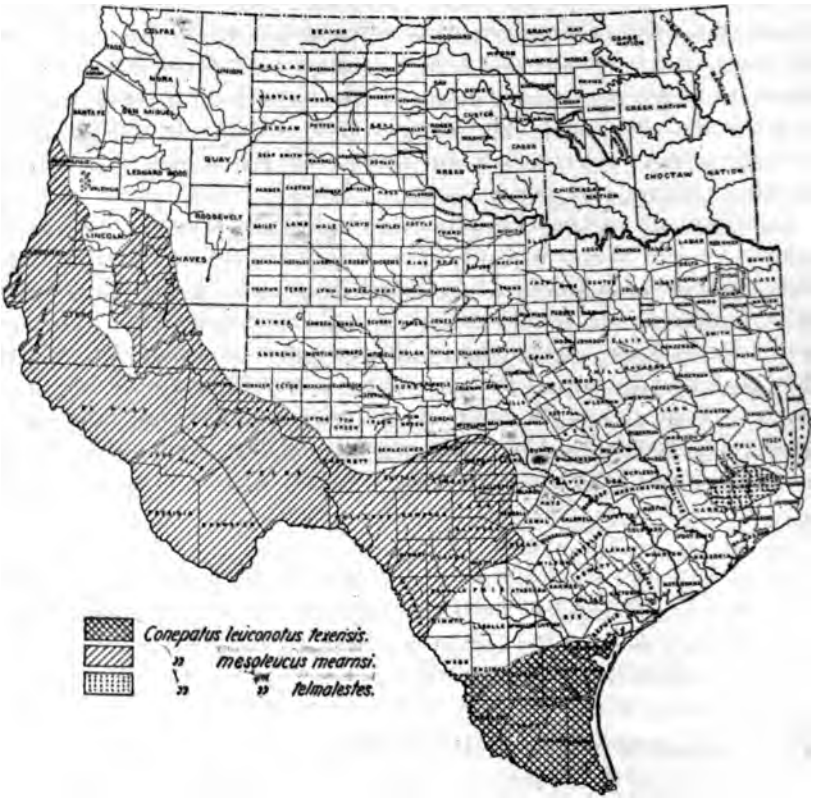

FIG. 24.—Distribution areas of white-backed skunks (genus *Conepatus*).

Skull of type.—Basal length, 65.2; zygomatic breadth, 44.3; interorbital breadth, 22.3; postorbital constriction, 20; mastoid breadth, 40.3; alveolar length of upper molar series, 16.3.

Three skins and four skulls have been examined from the Big Thicket, 7 to 10 miles northeast of Sour Lake, in Hardin County, and one skin and two skulls from Tarkington Prairie, in Liberty County.

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[a] The skull of a large male from Tarkington lacks the slender rostrum and narrow interorbital region, but agrees with the others in tooth characters and spreading mastoid processes.

At Saratoga, Kountze, and Cleveland the white-backed skunk is said to be the commonest species, and under a trapper's shed at a ranch on Tarkington Prairie in November, 1904, I saw eight or ten of their skins hanging up to dry with a smaller number of skins of *Mephitis* [illegible]. They were valued at 10 cents each, or less than half as much as the blacker skins of *Mephitis*.

Apparently no *Conepatus* are found in the country west of Liberty County until the range of *mearnsi* is reached near Austin, or that of the more widely different *texensis* at Rockport. The extension of range of the genus is less surprising than that a local form of a group so generally associated over a wide area with arid desert regions [illegible] be found restricted to the most humid and densely timbered [illegible] of the State of Texas.

The residents of the Big Thicket country are familiar with these animals, which they call "white-back skunks" to distinguish them from the black backed or two-striped *Mephitis*. I could not learn of any difference in habits or habitat of the two species. Gaut reports two females taken in April as nursing young, and with one of these he found two small young about a week old in a hollow stump. He also reports that the stomachs of three adults were filled with ground up insects mostly beetles with a few grubworms, large brown flies, and grasshoppers.

Conepatus leuconotus texensis Merriam. Texas Conepatus.

From Brownsville, on the lower Rio Grande, this larger form of the white-backed skunk extends up the coast as far as Rockport and up the Rio Grande Valley to Laredo. Lloyd, who collected specimens at Brownsville and Laredo, reported them as rare. He also reported [illegible] occurring occasionally on Padre Island and at Nueces Bay.

Scalops aquaticus (Linn.). Eastern Mole.

One specimen from Joaquin and fifteen specimens from the Big Thicket, 7 miles northeast of Sour Lake, show no distinguishing characters when compared with a large series of typical specimens from Virginia, Maryland, and the District of Columbia. The grayer, lighter color and larger molars indicate a shading toward [illegible] but in so slight a degree as to be merely a suggestion.

The sandy pine ridges of eastern Texas and [illegible] river bottoms and the low [illegible] innumerable mole ridges and [illegible] heaps of yellow sand pushed up through [illegible] leaves and pine needles. The moles are [illegible] borders of rivers have an almost [illegible] black wax land prairies. Their [illegible] greatest, sandiest soil, which is kept [illegible] tilled and [illegible] that in walking over it the feet constantly sink into the network of old burrows. In fields the freshly raised ridges can be traced for long distances. The moles are commonly accused of eating sweet potatoes, cutting the roots of fruit trees, and of doing other mischief, for most of which the pocket gopher or 'salamander' is responsible. The food of the moles consists almost entirely of insects, earthworms, and various other inhabitants of the soil, in pursuit of which the animals sometimes are troublesome by disturbing the roots of young plants and by marring the surface of lawns and parks with ridges and little mounds of earth. But all things considered the mole is too valuable an ally of the farmer to be destroyed.

Scalopus aquaticus texanus Allen. Texas Mole.

So far as known, *Scalopus texanus* is found only in semiarid Lower Sonoran zone, from Cameron County north to Mason. Specimens examined from Rockport, Corpus Christi, Santa Rosa Ranch (near northwest corner of Cameron County), Padre Island (north end), and Mason, as apparently also two imperfect specimens from San Antonio and Long Point, while showing marked variation at every locality from which perfect specimens were secured, can all be referred to this form. While at each locality the specimens are surprisingly uniform in characters, and the variation is sufficient for recognition, a careful comparison of specimens indicates that the result of further subdivision would only be confusing. The physiography of the middle Gulf region of Texas tends to the isolation of all burrowing mammals. Some of the rivers with headwaters in sandstone and granite formations cut through wide plains of the most impervious, waxy soil, in which no mammal can burrow, and while some of these streams leave more or less continuous deposits of mellow, sandy soil along their courses, others carry their contributions to the coast, to be built into interrupted areas of sand flats, dunes, and islands, between which the rivers with their wide flood bottoms form as impassable barriers as the wide stretches of waxy prairie. In some cases the isolation is complete; in others, partial. While the general conditions are similar, locally they are more or less varied, and their effect on the burrowing mammals is analogous to that on mammals found on a series of oceanic islands.

In habits *texanus* does not differ from other species of the genus At Corpus Christi it is common on the scattered patches of sandy soil, and common also over the sandy prairie for a distance of 65 miles, from near Santa Rosa to Sauz on the Alice and Brownsville stage road. Lloyd reported it as abundant on Padre Island. On the half-naked sands near the coast mole ridges are usually conspicuous, and the mounds, while less numerous, are often as large as those of the pocket gopher.

calopus aquaticus intermedius Elliot. Plains Mole.

Two specimens of moles from Mobeetie and three from Lipscomb, hile not typical *intermedius*, are nearer to it than to any other pecies. Externally they agree with topotypes from Alva, Okla., but e slender skulls indicate a distant connection with *aquaticus* farther ast. One of the specimens from Mobeetie is tinged all over with a elicate purple, evidently from the root juice of a *Lithospermum*.

Howell reports that these moles are more or less abundant at obeetie, Miami, Canadian, and Lipscomb, where their runways are specially numerous in cultivated fields, among the sand hills, or on andy bottoms, while a few were found on wet bottoms and on ground hat was flooded in times of high water. At Tascosa in 1899 I found ole ridges common over the sandy river bottoms.

[**Sorex personatus** Geoffroy Saint Hilaire. Common Eastern Shrew.

A specimen of this shrew, recorded by Mr. Oldfield Thomas[a] as received with the William Taylor collection from San Diego, Tex., is apparently the only record of a *Sorex* for the State. As numerous collectors have failed to find the species in the State, or anywhere within the life zone including San Diego and most of Texas, it seems probable that this specimen originally came from some other part of the country.]

otiosorex crawfordi (Coues) (Baird MS.). Crawford Shrew. Eared Shrew.

Notiosorex differs from *Blarina* in having 28 instead of 32 teeth. *N. crawfordi* is larger than *B. parva* or *berlandieri*, with more conspicuous ears, and with tail about 2½ instead of 1½ times as long as hind foot.

This shrew was described from specimens collected at old Fort Bliss, 2 miles above El Paso, and additional specimens have since been collected at San Diego, Corpus Christi, and San Antonio. It has a wide range in the arid Lower Sonoran zone of Mexico, southern California, and Arizona, and so far as we know reaches its eastern imit near Corpus Christi and at San Antonio.

arina brevicauda carolinensis (Bach.). Carolina Short-tailed Shrew.

A specimen of the Carolina short-tailed shrew from Joaquin and wo from the Big Thicket, 8 miles northeast of Sour Lake, extend the nge of this species from eastern Arkansas and western Mississippi to eastern Texas. Though these shrews are never abundant and are sily overlooked in collecting, they may yet be found over much of stern Texas where the conditions are favorable. Hollister caught e Joaquin specimen in a runway under old grass on low ground at the edge of a cotton field about a mile east of town. It was half eaten while in the trap by some other animal, probably by one of its own species. Gaut caught the two Big Thicket specimens in traps set by old logs in the woods near Mike Griffin's place.

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[a] Proc. Zool. Soc. London, 1888, p. 443.

Blarina parva (Say). Least Short-tailed Shrew.

This smallest of the United States species of short-tailed shrews has been taken at Gainesville, Hempstead, and Richmond. As throughout a wide range over the eastern United States it is a rare, or at least a rarely taken species, it may well be as common over a large part of eastern Texas as over the rest of its range.

The Gainesville specimens in the Merriam collection were taken by G. H. Ragsdale, but on the same ground in 1892 I was unable to find any trace of these animals save a few old runways under a carpet of fallen prairie grass. At Richmond in 1899, while trapping for *Sigmodon* on the big coast prairie, I caught one in its own little runway under the prairie grass. At Hempstead Gaut caught one in a trap set in the dry grass near a rain pool.

Blarina berlandieri Baird. Rio Grande Short-tailed Shrew.

The Rio Grande *Blarina* is slightly larger and paler than *parva*, but very similar in general appearance. It was described from specimens collected at Matamoras, Mexico, and other specimens have been taken at Brownsville, San Diego, and Del Rio, Tex. Little is known of its habits, which apparently are similar to those of *parva*.

At Del Rio in February, 1890, I caught one in a *Sigmodon* runway on grassy bottoms of San Felipe Creek a couple of miles from the point where the creek joins the Rio Grande.[a]

Myotis velifer (J. A. Allen). Cave Bat.

The four localities from which this little brown bat is known in Texas—the mouth of the Pecos, Langtry, New Braunfels, and San Antonio—when added to its wider range from Arizona to Missouri and south to southern Mexico, indicate that the species covers at least the western half of Texas. Specimens collected at mouth of Pecos by Lloyd, August 23 and September 4, 1890, and at Langtry by Gaut, March 29, 1893, indicate that it is a summer resident along the Rio Grande. Lloyd's specimens were "found in a cave tunnel," and Gaut's were taken in Pump Canyon, a deep box canyon near Langtry. I collected three adult males of this bat at Marble Cave, Mo., on June 28 and 30, 1892. One was caught in the cave 150 feet below the surface of the earth: the others were shot as they came out of the mouth cave in the evening. If this bat is habitually a cave dweller, stribution of caves probably accounts for its somewhat erratic

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[a] This Del Rio specimen, which is typical *berlandieri*, was by some accident referred by Doctor Merriam to *parva*, although he had previously written the name *berlandieri* against it in the catalogue. (N. Am. Fauna, No. 10, p. 18, *1895—Revision* of Shrews.)

s californicus (Aud. and Bach.). Little California Bat.

tiny bright brown bat comes into the desert country of western s, but evidently is not very common. A single specimen collected isano by Lloyd on July 21, and another that I shot at Peña d, 5 miles south of Marathon, May 14, and one on Terlingua , July 1, seem to furnish the only records for the State. The s is common in New Mexico just north of the Texas line. Five ens, three males and two females, collected by James H. , the foothills on the east slope of the San Andreas Mountains, Mexico, January 19 and 20, 1903, indicate that the bats are not resident, but are active during winter months. At Santa Rosa, ex., I found them common in May, and a female shot on the 29th ed one small embryo. On the wing they are scarcely distin able from *Pipistrellus hesperus*, but they are usually found in en or among trees, while *hesperus* keeps mainly to the canyons iffs.

s incautus (J. A. Allen). House Bat.

parently the only known specimens of this bat are the five taken n Antonio by Mr. H. P. Attwater, from which Doctor Allen ed the species; seven collected by M. Cary and myself 15 west of Japonica, Kerr County; one collected at Langtry by s H. Gaut, and eight collected at Carlsbad, N. Mex. The San o specimens were collected March 12 and October 10, which suggest that they were migrants. The Japonica specimens taken July 7 and 8, and were on their breeding ground, as prob were those taken at Carlsbad July 29 and September 17. A e collected in Pump Canyon, near Langtry, March 29, may have either resident or migrant.

tle is known of the habits of this species. On the North Fork Guadalupe, west of Japonica, Cary and I found them early in evening, flying up and down the rocky bed of the stream in abundance, dipping to the water pools to drink and then zig ing through the air in pursuit of insects. With a fairly good e secured seven of the bats after a few minutes' rapid shooting bats apparently came from the limestone cliffs [illegible] the open space where we found them.

the water tower 3 miles southwest of Carlsbad, where a large is formed from the pure mountain water pumped up to sup he town, these bats came in over the dry plain on the even of July 29 from some limestone hills several miles away

They were flying straight for the water pool without a crook or turn, and I shot four without missing, a rare occurrence in bat shooting. These were all females, but four taken on September 17 at the Bolles ranch, 6 miles south of Carlsbad, were all males. Three of these were shot in the evening as they flew about the house, and one was caught in the daytime in a corner of an outhouse.

In the original description of the species, based on a series of five specimens taken at San Antonio by Mr. Attwater, March 12 and October 10, Doctor Allen says: "It is a 'house' bat, all of the specimens having been taken in the house except one, which was caught in a barn." [a]

Myotis yumanensis (H. Allen). Yuma Bat.

This little light-brown bat was not known from Texas until May 26, 1903, when Gaut found a breeding colony near Del Rio. He collected a series of eight adult females and one young, and says: "They were taken from a colony of bats, all the same species, in a shallow cave near the railroad about 10 miles west of Del Rio. When disturbed they flew about, the females each carrying a young one clinging to its breast. One of these young was obtained and prepared." It was very small, almost naked, and apparently its eyes were not yet open.

Pipistrellus hesperus (H. Allen). Little Canyon Bat.

These tiny gray bats are easily recognized by their jet-black ears, tail, and wings. They come into arid Lower Sonoran zone of western Texas as far east as the Pecos Valley. There are specimens from El Paso, Chinati Mountains, Grand Canyon of Rio Grande, Terlingua Creek, Boquillas, points 15, 20, and 80 miles south of Marathon, Alpine, Paisano, Davis Mountains (east base), Sanderson, Pecos River (at mouth), and farther up the Pecos Valley from near Carlsbad and Santa Rosa, N. Mex.

These bats are usually the most abundant of the species where they occur, and they are, more than any other species I know, strictly canyon or cliff dwellers. They often follow up the canyons to the extreme limits of Lower Sonoran zone on the warm slopes where the surrounding country is entirely Upper Sonoran or even Transition, and the hotter, dryer, and barer the canyon the thicker these midgets swarm. They fly early, sometimes coming out on the shady side of a canyon before the last trace of sunlight has disappeared, but even with a fair amount of light they are not easily shot. Their flight is rapid and crooked, and the collector wastes more ammunition on them than on almost any other bat.

The Texas records for this species are all for summer, May 10 to

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[a] Bul. Am. Mus. Nat. Hist., VIII, 239, 1896.

August 26, and breeding specimens are found throughout their range. A female collected 20 miles south of Marathon, May 10, contained two half-developed embryos, and two collected near Boquillas, May 23 and 24, each contained one large embryo. Another taken at Santa Rosa, N. Mex., May 27, contained two small embryos.

In specimens of this bat shot only a few minutes (twenty or thirty at most) after they began to fly in the evening, I have invariably found the stomachs stuffed full of freshly eaten insects—a fact which speaks well for their skill as flycatchers.

Pipistrellus subflavus (F. Cuvier). Georgian Bat.

Specimens of the Georgian bat from Clear Creek, in Galveston County, Long Lake, Brownsville, Devils River, Comstock, and Del Rio indicate a range over the eastern part of the State and as far west as the timber extends along streams in Lower Sonoran zone. The species has a wide range over the southeastern United States, and finds its western limits in Texas. The Brownsville specimen collected October 10, 1891, may have been a migrant, as may also have been those from Clear Creek, taken on March 28. One from Devils River, collected July 23, and three from Long Lake, procured July 19 and 20, were undoubtedly on their breeding grounds, as were probably those from Del Rio, collected May 21 and 22, and one from Comstock, collected May 3.

Vespertilio fuscus Beauvois. Large Brown Bat.

Specimens of the brown bat from Jefferson, Sour Lake, the Brazos River, Grady, and the Davis and Chisos mountains carry the rang of the species across Texas from east to west without defining any limits of range, but the species apparently has not been taken in the southern part of the State. The specimen collected by Hollister at Jefferson, June 14, may have been a late migrant, as the specie is supposed not to breed in Lower Sonoran zone. One collected by Gaut near Sour Lake, March 17, was undoubtedly a migrant. The Brazos River specimen is an old alcoholic (No. 11217, U.S.N.M.), without date. The Davis and Chisos mountains specimens were in Transition zone, and probably on their breeding grounds. Both are males, and in both localities the species seemed to be common. The one from the Davis Mountains was shot by L. A. Fuertes on the evening of July 12 as it came down the gulch over our camp at 5,700 feet altitude. The Chisos Mountain specimen was shot by McClure Surber, June 9, at our camp in the gulch at 6,000 feet altitude, at the edge of Transition zone.

At Mr. C. O. Finley's ranch, at the west base of the Davis Mountains, I found two lower jaws of this bat among numerous other bones in pellets under the nest of a great horned owl.

Lasiurus borealis (Müller). Red Bat.

The red bat is common over eastern Texas and westward to the lower Rio Grande, Devils River, and Wichita Falls. Specimens have been taken at Jefferson, Clarksville, Arthur, Paris, Waco, Tarkington Prairie, Wichita Falls, Camp Verde, Ingram, Nueces Bay, Corpus Christi, Brownsville, Fort Clark, and Devils River. Its western limit in the State apparently corresponds to the limit of essentially treeless plains. Being a tree bat and partial to the deep shade of bottom-land forests, it follows the stream courses into the plains as far as they carry timber.

The dates on Texas specimens, covering a period from March 19 to November 30, do not indicate whether the species is migratory or resident, or whether, if resident, it hibernates or is active during the winter months, but there is abundant proof that it breeds throughout its Texas range. A female shot at Clarksville June 10 contained two fully developed fetuses, as also another, shot the next evening at Paris. Two females shot at Paris June 11, and 3 at Arthur June 16, were all nursing young. In a large series of specimens collected by F. B. Armstrong at Brownsville there are 39 young, ranging in size from tiny, almost naked individuals a few days old to almost full-grown animals, and bearing dates from May 19 to July 25. Most of the very small young were taken in May, but one of the smallest is dated July 18. Adults were collected at Brownsville by Lloyd as late as September 10, at Corpus Christi November 13, and at San Patricio, near the mouth of the Nueces, November 30.

These bats are among the least difficult to collect, as they come out early in the evening and their flight is comparatively slow. In leafy woods they often come out soon after sundown, while there is still light enough to distinguish the species by its color, form, and flight. At Wichita Falls I shot one as it was flying about in the woods near the river in bright sunlight at about 4 p. m. In the big pecan grove near the head of Devils River they were very numerous in July.

Lasiurus borealis seminolus (Rhoads). Florida Red Bat.

A single specimen of this rich mahogany-brown subspecies, recorded by Gerrit S. Miller, jr., from Brownsville[a] is the only record for Texas. It was killed September 8, 1891, and was probably a migrant from its usual summer range in the South Atlantic and Gulf States east of Texas. Upon all grounds of geographic distribution this bat should be a summer resident of eastern Texas, and it will probably be found there when this most neglected group of all our North American mammals becomes better known.

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[a] N. Am. Fauna, No. 13, p. 109, 1897. Revision of N. Am. Bats of the Family *Vespertilionidæ*, by Gerrit S. Miller, jr.

U. S. DEPARTMENT OF AGRICULTURE
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Prepared under the direction of
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CHIEF OF BUREAU OF BIOLOGICAL SURVEY

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Corynorhinus macrotis pallescens Miller. Long-eared Bat.

A single specimen of this pale subspecies of the long-eared bat, collected by Lloyd in the "east" Painted Cave, September 5, 1890,[a] apparently forms the only record for Texas. From its wide range over Mexico and arid Lower Sonoran of southern California and Arizona, the species may be expected to inhabit at least a large part of western Texas. In the eastern part of the State its place would naturally be taken by the darker colored *macrotis*, which has not yet been recorded from Texas, but which breeds abundantly in southern Louisiana.

Antrozous pallidus (Le Conte). Pale Bat.

This large, light-colored bat is common throughout the summer in arid Lower Sonoran zone of western Texas from Sycamore Creek, Devils River, and the Pecos Valley westward, and a single specimen was obtained at Tascosa, in the northwestern part of the Panhandle. The records cover a period from April 18 to October 11, but these limits are apparently dates of collectors' entering and leaving the region rather than of the migration of the bats. Still in the Rio Grande Valley enough winter work has been done to prove that the bats either migrate or hibernate during cold weather. That they breed in the region is amply proved by their remaining throughout the summer months, and by a female shot near Boquillas, May 28, and three females taken at Comstock May 11, each containing two large fetuses. Lloyd collected a half-grown young at Paisano, July 18.

During the day they hide in cracks of buildings, and probably also in cliffs, as they inhabit rocky country where there are no buildings. At Comstock, May 11, 1901, Oberholser found "eight or nine roosting behind the signboard of a store, and they were said to have been driven from a similar place at the railroad station." He secured five of these, which proved to be four females and one male. On July 24 and 25 of the following year Hollister caught seven more (four males and three females) from behind the signboard at the railroad station at Comstock. At Van Horn one came into my room in the evening of August 23, and was caught. Near Carlsbad, N. Mex., these bats were abundant around the house on the Bolles ranch in September, coming out of cracks in buildings early in the evening and flying softly around the house in the twilight before the smaller bats began to appear. During the day I often heard them squeaking behind the casings, and with a pair of forceps took five from behind a board. Of six specimens taken, three were males and three females. In this species I have never found a striking preponderance of either sex, probably because I have found them only in the breeding season.

---

[a] Probably the third cave, about a mile below the mouth of the Pecos.

Their flight is soft and noiseless, and, while rapid, it is not so quick and jerky as that of most bats. Their light color and large size render them unmistakable in the early evening; even the long, projecting ears can sometimes be distinguished as the bats fly over. An old female, previously mentioned as containing two fetuses, measured 315 mm. (approximately a foot) from tip to tip of wings when fresh.

Nyctinomus mexicanus Saussure. Free-tailed Bat.

The free-tailed bat is the most abundant species over approximately the western half of Texas in arid Lower Sonoran zone. Its eastern limit of range, so far as known, agrees closely with the eastern limits of mesquite. There is a specimen in the U. S. National Museum collection labeled Indianola. The species is abundant at San Antonio, and I have examined specimens from Brazos, San Angelo, Kerrville, Ingram, Padre Island, Brownsville, Hidalgo, Eagle Pass, Del Rio, Comstock, mouth of Pecos, Langtry, Boquillas, Alpine, Davis Mountains, Fort Stockton, and up the Pecos Valley as far as Roswell, N. Mex. The abundant bats in the town of El Paso are probably of this species.

In at least a part of their Texas range these bats are not only resident, but active throughout the winter months. At Del Rio I found them abundant in January and February, 1889; Lloyd and Streator found them common at Eagle Pass in November, and Lloyd collected one on Padre Island November 11. At Brazos Cary found them as late as October 9, 1902, and says: "I shot twenty of these bats in a crack in the bridge where the Texas Pacific Railroad crosses the Brazos. The bats were in the cracks by hundreds." Most of his October specimens are very fat, which would suggest that later they might have hibernated. At San Angelo Oberholser reported the species April 2 to 4, 1901: "Abundant along the Concho, where one was taken. All the bats seen were apparently of this genus." At Fort Stockton, in August, Cary reports them as the "most abundant bat." At Alpine, July 5, they swarmed out of the adobe walls of empty houses in the evening until the town was full of them and their musky odor. A few were shot in the canyons of the Davis Mountains July 10, and their unmistakable odor was very noticeable along the old adobe walls at Fort Davis. At the ranch of Mr. Howard Lacey, near Kerrville, these bats were common May [illegible] 1899. Some were shot around the ranch buildings [illegible] and one of their roosting places was found in a crack under an overhanging rock of a high cliff. I heard them squeaking and apparently fighting in the crack. A few shots of the auxiliary brought sixteen of them to the ground, and examination showed these to be males and females in about equal numbers. The embryos in these females were just beginning to enlarge noticeably, but a female shot at Boquillas May 28 contained a half-developed embryo. On a hot May evening in San Antonio I have watched a stream of these bats fly from under the cornice of the old adobe hotel, making the hot air heavy with their odor. They are partial to towns and adobe houses. At Del Rio, in January and February, 1889, they were excessively numerous. At dusk the air seemed full of them, and several people told me that their houses were so infested with bats that no one would rent them. On visiting one of these vacant houses in the evening I found bats pouring out of cracks and holes in the boards that covered the adobe walls. There was an incessant squeaking and scratching as they climbed over the inner surface of the boards and fought and pushed each other at the narrow places of exit. The noise could be heard across the street. I stood at a knothole and caught them as they came out one at a time, until I had nine in my hands, but by the time I had dispatched these the others were all out and on the wing. My specimens were covered with lice and redolent with a peculiar rank, musky odor that did not leave my hands for a couple of days. The odor is like that of the house mouse, only much stronger, and it is often noticeable as you walk along the sidewalk past some of the bat-infested houses.

Promops californicus (Merriam). Bonnet Bat.

A single specimen of this large bat, collected at Langtry, Tex., March 8, 1903, by James H. Gaut, adds the species to the Texas fauna and extends its range from the southern parts of Arizona and California. Gaut says it was caught in the pump house at the bottom of Pump Canyon, near Langtry.

Mormoops megalophylla senicula Rehn. Rehn Bat.

The only specimen of this Mexican and West Indian bat recorded from the United States was taken by Dr. E. A. Mearns at Fort Clark, Tex., December 3, 1897. Doctor Mearns says:

> A lady called me to her house to see a 'very remarkable bat' which had attached itself to the inner side of a door-screen. I found this bat very much alive, at a season when all other bats of the locality were dormant or had migrated. No other bats were seen until the following March, when the common *Nyctinomus* reappeared in the usual abundance.[a]

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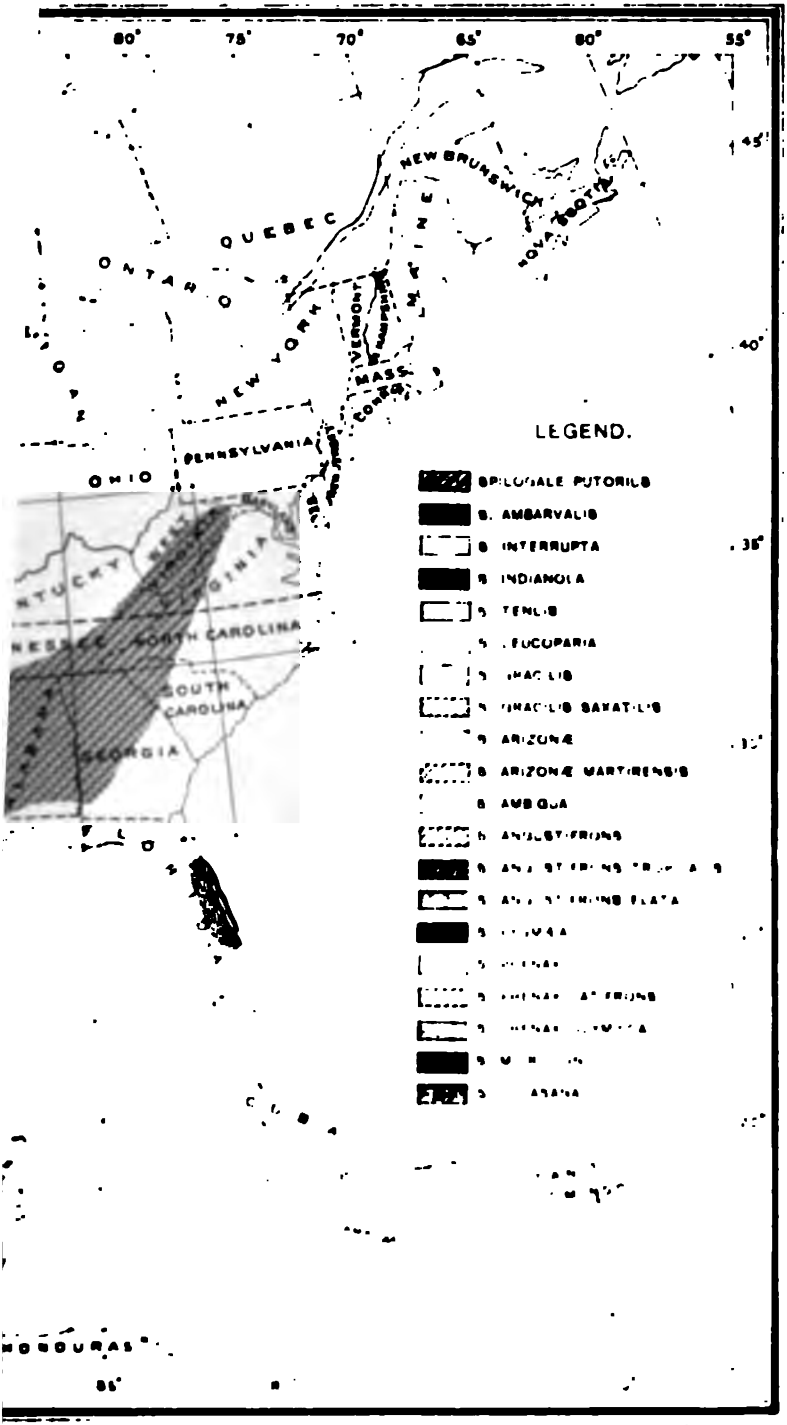
[a] Proc. Biol. Soc. Wash., XIII, p. 166, 1900.

PLATE I.



GENUS SPILOGALE

Castela nicholsonii, 18.
Castor canadensis frondator, 124–127.
  canadensis texensis, 11, 122–124.
Cat, leopard, 166.
  red and gray, 14, 167.
Cenchrus tribuloides, 87.
Cephalanthus occidentalis, 25.
Cercocarpus parvifolius, 33, 71.
Cereus stramineus, 86.
Cervus canadensis, 60.
  merriami, 60.
Chameleon, Carolina, 39.
Chionactis episcopus isozonus, 47.
Chipmunk, gray-footed, 81.
Chordeiles henryi, 33.
Citellus mexicanus parvidens, 47, 86.
  spilosoma annectens, 88.
  spilosoma arens, 88.
  spilosoma major, 87–88.
  spilosoma marginatus, 88.
  tridecemlineatus pallidus, 87.
  tridecemlineatus texensis, 86–87.
  variegatus buckleyi, 84–85.
  variegatus couchi, 83–84.
  variegatus grammurus, 85–86.
Civet cat, 182.
Cnemidophorus gularis, 44.
  perplexus, 44.
  sexlineatus, 44.
  tessellatus, 44.
Coast marshes, 20.
  prairie, 19.
Coati, 192.
Cœligena clemenciæ, 33.
Coleonyx brevis, 44.
Condalia obovata, 24.
Conepatus leuconotus texensis, 204, 205.
  Mearns, 202.
  mesoleucus mearnsi, 202, 204.
  mesoleucus telmalestes, 11, 203–205.
  Texas, 205.
Coon, 192.
Copperhead, 49.
Coreopsis, 19.
Corynorhinus macrotis pallescens, 214.
Cottonmouth, 49.
Cotton rat, Berlandier, 117.
  Chisos Mountain, 118.
  Texas, 114.
Cottontail, Bangs, 156.
  Chapman, 156.
  desert, 157.
  mountain, 159.
  plains, 159.
Cougar, Mexican, 162.
Covillea tridentata, distribution of, 25.
Coyote, Mearns, 177.
  plains, 174.
  small-toothed, 178.
  Texas, 175.
Crassina grandiflora, 97.
Cratogeomys castanops, 132–133.
Creosote bush, 25.
Crotalus atrox, 49.
  confluentus, 50.
  horridus, 39, 49.
Crotalus lepidus, 51.
  molossus, 50.
Crotaphytus collaris, 39.
  collaris baileyi, 40.
  reticulatus, 40.
  wislizenii, 40.
Cynomys ludovicianus, 89–92.
Cyrtonyx mearnsi, 33.
Dasylirion texanum, 31, 66.
Dasypterus intermedius, 213.
Dasypus novemcinctus var. *mexicanus*, 52.
Daubentonia longifolia, 17, 20.
Deer, gray mule, 65.
  plains white-tailed, 63.
  Sonora, 64.
  Texas white-tailed, 60.
  white-tailed, 61.
Diadophis regalis, 45.
Didelphis marsupialis texensis, 57–58.
  virginiana, 56–57.
  virginiana pigra, 19, 57.
Diospyros virginiana, 32.
Dipodomys elator, 148–149.
  merriami, 149–150.
  merriami ambiguus, 150.
  spectabilis, 118, 147, 148.
Drymarchon corais melanurus, 47.
Drymobius margaritiferus, 46.
Elaps fulvius, 39, 48.
Ephedra trifurcata, 74.
Erethizon epixanthum, 150–151.
Eumeces brevilineatus, 45.
  guttulatus, 45.
  obsoletus, 45.
  quinquelineatus, 45.
Eustoma, 19.
Eutainia cyrtopsis, 48.
  elegans marciana, 39, 48.
  proxima, 48.
Eutamias cinereicollis canipes, 81.
Fallugia paradoxa, 33.
Felis apache, 167.
  cacomitli, 167–169.
  coryi, 163.
  couguar, 163.
  eyra, 167.
  hippolestes aztecus, 162–163.
  onca, 163.
  onca hernandezi, 163–166.
  pardalis, 166.
  pardalis limitis, 166–167.
  yaguarundi, 167.
Ferret, black-footed, 197.
Fiber zibethicus, 120–121.
  zibethicus ripensis, 121–122.
Flying squirrel, Florida, 79.
Fox, Florida gray, 182.
  gray, 180.
  kit, 179.
  New Mexico desert, 179.
  red, 178.
Fox squirrel, Louisiana, 75.
  western, 75.
  Texas, 77.
Garrya lindheimeri, 33.
  wrighti, 74.
Gecko, 44.

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Manfreda maculosa, 18, 24.
Massasauga, 49.
Megaquiscalus, 17.
Mephitis mesomelas, 200-201.
  mesomelas varians, 201, 202.
Meriolix, 19.
Merriam elk, 60.
Mesophytic plant region, 23.
Mesquite, 31.
Microrhamnus, 88.
Microtus ludovicianus, 19, 119-120.
  mexicanus guadalupensis, 119.
  pinetorum auricularis, 120.
Mimosa biuncifera, 83.
Mink, large brown, 196.
  southeastern, 196.
Mole, eastern, 205.
  plains, 207.
  Texas, 206.
Momesia pallida, 24, 104, 157, 195.
Monarda, 19.
Morella cerifera, 20.
Mormoops megalophylla senicula, 216.
Mountain lion, 162.
  sheep, 70-75.
Mouse, grasshopper, 93.
  harvest, 104, 105, 106.
  house, 92.
  pocket, 135, 137, 138, 139, 140, 141, 142, 143.
  white-footed, 94, 95, 96.
Mus alexandrinus, 93.
  musculus, 92.
  norvegicus, 92.
  rattus, 92.
Musk hog, 58.
Muskrat, 120.
  Pecos River, 121.
Myotis californicus, 209.
  incautus, 209-210.
  velifer, 208.
  yumanensis, 210.
Nasua narica yucatanica, 14, 192.
Natrix clarkii, 47.
  fasciata transversa, 47.
Neotoma albigula, 113-114.
  floridana attwateri, 110-111.
  floridana baileyi, 109-110.
  floridana rubida, 107-109.
  mexicana, 114.
  micropus, 111-113.
New species of mammals, 10-11.
Nolina lindheimeriana, 65.
  texana, 33.
Notiosorex crawfordi, 207.
Numenius longirostris, 33.
Nuttallornis borealis, 88.
Nycticeius humeralis, 213.
Nyctinomus mexicanus, 215.
Ocelot, 14, 166.
Odocoileus couesi, 61, 64-65.
  hemionus, 65.
Odocoileus hemionus canus, 65-67.
  louisianæ, 61.
  virginianus, 61-63.
  virginianus macrourus, 63-64.
  virginianus texanus, 60-63, 64.
Onychomys leucogaster pallescens, 93-94.
  longipes, 93.
  torridus, 94.
  torridus arenicola, 94.
Opheodrys æstivus, 46.
Ophisaurus ventralis, 44.
Opossum, Florida, 57.
  Texas, 57.
  Virginia, 56.
Opuntia arborescens, 154.
  cymochila, 33.
  engelmanni, 24, 25, 75, 83, 84, 85, 86, 181, 195, 200, 208.
  lepticaulis, 24.
  macrorhiza, 87.
Oryzomys aquaticus, 104.
  palustris, 19, 103-104.
  palustris texensis, 103.
Otocoris leucolæma, 33.
Otter, 195.
Ovis mexicanus, 70-75.
Padre Island, 20, 24.
Panther, 162.
  Adirondack, 163.
  Florida, 163.
Parabuteo u. harrisi, 112.
Parkinsonia aculeata, 17, 24.
Peccary, Texas, 58.
Pedomys, 119.
Pentstemon, 65, 75.
Perodipus compactus, 20, 146, 147.
  montanus richardsoni, 144-145.
  ordi, 144.
  sennetti, 145-146.
Perognathus flavescens copei, 143.
  flavus, 140-141.
  hispidus, 135-137, 200.
  hispidus paradoxus, 137-138.
  hispidus spilotus, 138.
  intermedius, 139-140.
  merriami, 141-142.
  merriami gilvus, 142-143.
  nelsoni, 140.
  nelsoni canescens, 140.
  penicillatus eremicus, 138-139.
Peromyscus, Attwater, 100.
  attwateri, 100.
  boylei laceyi, 11, 99-100.
  boylii penicillatus, 98.
  boylei rowleyi, 98.
  canus, 96.
  desert, 100.
  eremicus, 100-101.
  eremicus arenarius, 100.
  frosted, 97.
  gossypinus, 97-98.
  Lacey, 99.
  leucopus, 94-95.
  leucopus mearnsi, 96.
  leucopus texanus, 95-96.
  little pale, 96.
  michiganensis pallescens, 96-97
  pine woods, 97.
  Rowley, 98.
  Sonoran, 97.
  sonoriensis, 97.
  sonoriensis blandus, 97.
  taylori, 16, 19, 101-102.
  taylori subater, 11, 17, 19, 102-103,
  tornillo, 95.
Persimmon, black, 32.
  Japanese, 31.
  Texan, 31.
  yellow, 32.

CONTENTS.

Page
Introduction 5
  History and material 5
  Distribution 7
  Habits 7
  Food 8
  External characters 9
  Nomenclature 10
    Generic names 10
    Specific names 11
Genus [illegible] 12
  Generic characters 12
  Key to species and subspecies 12
  List of species and subspecies, with type localities . . . . [illegible]
  Descriptions of species and subspecies 14
  Table of cranial measurements . . . . [illegible]

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Corynorhinus macrotis pallescens Miller. Long-eared Bat.

A single specimen of this pale subspecies of the long-eared bat, collected by Lloyd in the "east" Painted Cave, September 5, 1890,[a] apparently forms the only record for Texas. From its wide range over Mexico and arid Lower Sonoran of southern California and Arizona, the species may be expected to inhabit at least a large part of western Texas. In the eastern part of the State its place would naturally be taken by the darker colored *macrotis*, which has not yet been recorded from Texas, but which breeds abundantly in southern Louisiana.

Antrozous pallidus (Le Conte). Pale Bat.

This large, light-colored bat is common throughout the summer in arid Lower Sonoran zone of western Texas from Sycamore Creek, Devils River, and the Pecos Valley westward, and a single specimen was obtained at Tascosa, in the northwestern part of the Panhandle. The records cover a period from April 18 to October 11, but these limits are apparently dates of collectors' entering and leaving the region rather than of the migration of the bats. Still in the Rio Grande Valley enough winter work has been done to prove that the bats either migrate or hibernate during cold weather. That they breed in the region is amply proved by their remaining throughout the summer months, and by a female shot near Boquillas, May 28, and three females taken at Comstock May 11, each containing two large fetuses. Lloyd collected a half-grown young at Paisano, July 18.

During the day they hide in cracks of buildings, and probably also in cliffs, as they inhabit rocky country where there are no buildings. At Comstock, May 11, 1901, Oberholser found "eight or nine roosting behind the signboard of a store, and they were said to have been driven from a similar place at the railroad station." He secured five of these, which proved to be four females and one male. On July 24 and 25 of the following year Hollister caught seven more (four males and three females) from behind the signboard at the railroad station at Comstock. At Van Horn one came into my room in the evening of August 23, and was caught. Near Carlsbad, N. Mex., these bats were abundant around the house on the Bolles ranch in September, coming out of cracks in buildings early in the evening and flying softly around the house in the twilight before the smaller bats began to appear. During the day I often heard them squeaking behind the casings, and with a pair of forceps took five from behind a board. Of six specimens taken, three were males and three females. In this species I have never found a striking preponderance of either sex, probably because I have found them only in the breeding season.

---

[a] Probably the third cave, about a mile below the mouth of the Pecos.

Their flight is soft and noiseless, and, while rapid, it is not so quick and jerky as that of most bats. Their light color and large size render them unmistakable in the early evening; even the long, projecting ears can sometimes be distinguished as the bats fly over. An old female, previously mentioned as containing two fetuses, measured 345 mm. (approximately a foot) from tip to tip of wings while fresh.

Nyctinomus mexicanus Saussure. Free-tailed Bat.

The free-tailed bat is the most abundant species over approximately the western half of Texas in arid Lower Sonoran zone. Its eastern limit of range, so far as known, agrees closely with the eastern limits of mesquite. There is a specimen in the U. S. National Museum collection labeled Indianola. The species is abundant at San Antonio, and I have examined specimens from Brazos, San Angelo, Kerrville, Ingram, Padre Island, Brownsville, Hidalgo, Eagle Pass, Del Rio, Comstock, mouth of Pecos, Langtry, Boquillas, Alpine, Davis Mountains, Fort Stockton, and up the Pecos Valley as far as Roswell, N. Mex. The abundant bats in the town of El Paso are probably of this species.

In at least a part of their Texas range these bats are not only resident, but active throughout the winter months. At Del Rio I found them abundant in January and February, 1889; Lloyd and Streator found them common at Eagle Pass in November, and Lloyd collected one on Padre Island November 11. At Brazos Cary found them as late as October 9, 1902, and says: "I shot twenty of these bats in a crack in the bridge where the Texas Pacific Railroad crosses the Brazos. The bats were in the cracks by hundreds." Most of his alcoholic specimens are very fat, which would suggest that later they might have hibernated. At San Angelo Oberholser reported the species April 2 to 4, 1901: "Abundant along the Concho, where one was taken. All the bats seen were apparently of this genus." At Fort Stockton, in August, Cary reports them as the "most abundant bat." At Alpine, July 5, they swarmed out of the adobe walls of empty houses in the evening until the town was full of them and their musky odor. A few were shot in the canyons of the Davis Mountains July 10, and their unmistakable odor was very noticeable among the old adobe walls at Fort Davis. At the ranch of Mr. Howard Lacey, near Kerrville, these bats were numerous May 1 to 7, 1899. Some were shot around the ranch buildings in the evening, and one of their roosting places was found in a crack under an overhanging rock of a high cliff. I heard them squeaking and apparently fighting in the crack. A few shots of the auxiliary brought sixteen of them to the ground, and examination showed these to be males and females in about equal numbers. The embryos in these females were just beginning to enlarge noticeably, but a female shot at Boquillas May 28 contained a half-developed embryo. On a hot May evening in San Antonio I have watched a stream of these bats fly from under the cornice of the old adobe hotel, making the hot air heavy with their odor. They are partial to towns and adobe houses. At Del Rio, in January and February, 1889, they were excessively numerous. At dusk the air seemed full of them, and several people told me that their houses were so infested with bats that no one would rent them. On visiting one of these vacant houses in the evening I found bats pouring out of cracks and holes in the boards that covered the adobe walls. There was an incessant squeaking and scratching as they climbed over the inner surface of the boards and fought and pushed each other at the narrow places of exit. The noise could be heard across the street. I stood at a knothole and caught them as they came out one at a time, until I had nine in my hands, but by the time I had dispatched these the others were all out and on the wing. My specimens were covered with lice and redolent with a peculiar rank, musky odor that did not leave my hands for a couple of days. The odor is like that of the house mouse, only much stronger, and it is often noticeable as you walk along the sidewalk past some of the bat-infested houses.

Promops californicus (Merriam). Bonnet Bat.

A single specimen of this large bat, collected at Langtry, Tex., March 8, 1903, by James H. Gaut, adds the species to the Texas fauna and extends its range from the southern parts of Arizona and California. Gaut says it was caught in the pump house at the bottom of Pump Canyon, near Langtry.

Mormoops megalophylla senicula Rehn. Rehn Bat.

The only specimen of this Mexican and West Indian bat recorded from the United States was taken by Dr. E. A. Mearns at Fort Clark, Tex., December 3, 1897. Doctor Mearns says:

> A lady called me to her house to see a 'very remarkable bat' which had attached itself to the inner side of a door-screen. I found this bat very much alive, at a season when all other bats of the locality were dormant or had migrated. No other bats were seen until the following March, when the common *Nyctinomus* reappeared in the usual abundance.[a]

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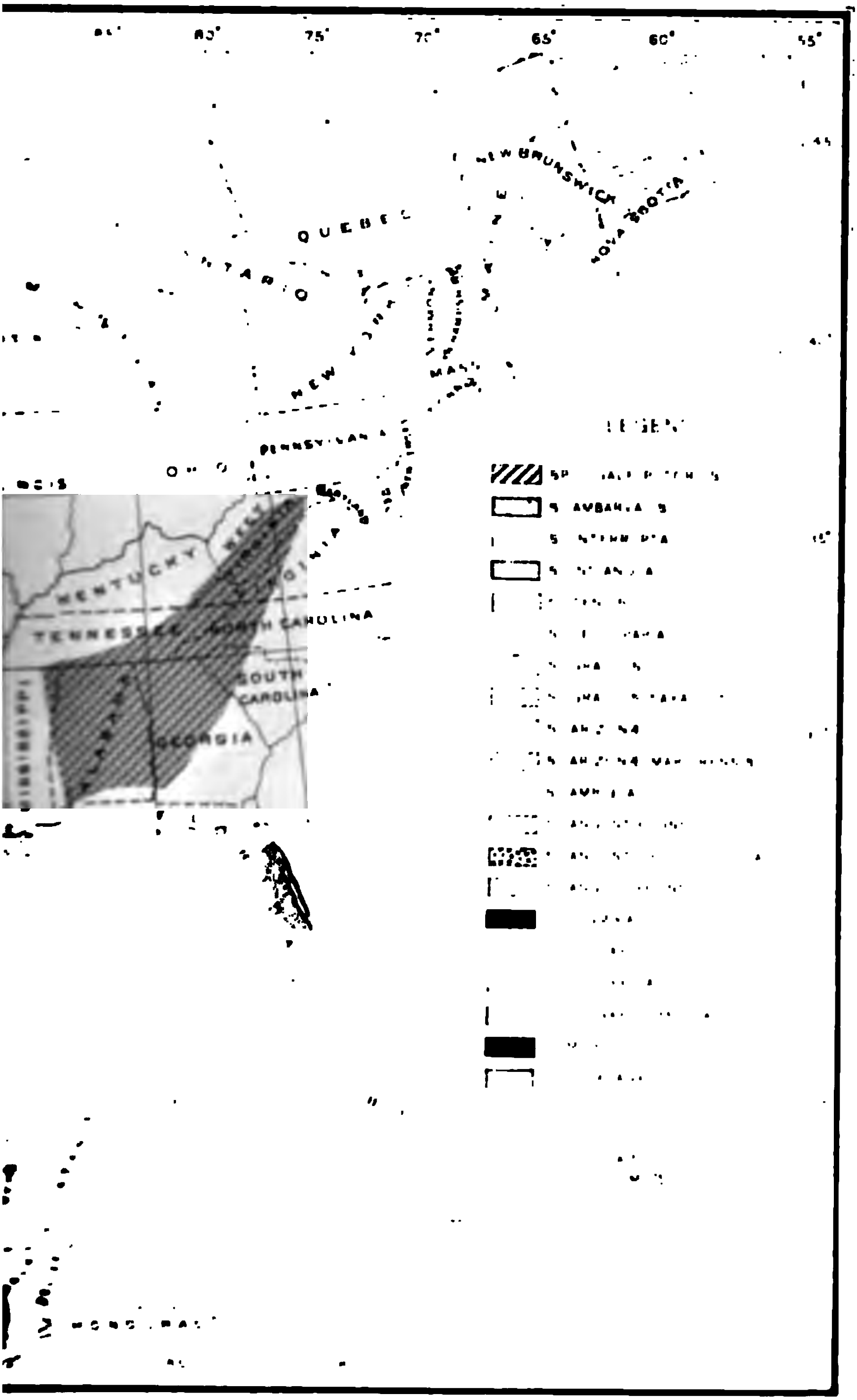
[a] Proc. Biol. Soc. Wash., XIII, p. 166, 1900.

Castela nicholsonii, 18.
Castor canadensis frondator, 124–127.
  canadensis texensis, 11, 122–124.
Cat, leopard, 166.
  red and gray, 14, 167.
Cenchrus tribuloides, 87.
Cephalanthus occidentalis, 25.
Cercocarpus parvifolius, 33, 71.
Cereus stramineus, 86.
Cervus canadensis, 60.
  merriami, 60.
Chameleon, Carolina, 39.
Chionactis episcopus isozonus, 47.
Chipmunk, gray-footed, 81.
Chordeiles henryi, 33.
Citellus mexicanus parvidens, 47, 86.
  spilosoma annectens, 88.
  spilosoma arens, 88.
  spilosoma major, 87–88.
  spilosoma marginatus, 88.
  tridecemlineatus pallidus, 87.
  tridecemlineatus texensis, 86–87.
  variegatus buckleyi, 84–85.
  variegatus couchi, 83–84.
  variegatus grammurus, 85–86.
Civet cat, 182.
Cnemidophorus gularis, 44.
  perplexus, 44.
  sexlineatus, 44.
  tessellatus, 44.
Coast marshes, 20.
  prairie, 19.
Coati, 192.
Cœligena clemenciæ, 33.
Coleonyx brevis, 44.
Condalia obovata, 24.
Conepatus leuconotus texensis, 204, 205.
  Mearns, 202.
  mesoleucus mearnsi, 202, 204.
  mesoleucus telmalestes, 11, 203–205.
  Texas, 205.
Coon, 192.
Copperhead, 49.
Coreopsis, 19.
Corynorhinus macrotis pallescens, 214.
Cottonmouth, 49.
Cotton rat, Berlandier, 117.
  Chisos Mountain, 118.
  Texas, 114.
Cottontail, Bangs, 156.
  Chapman, 156.
  desert, 157.
  mountain, 159.
  plains, 159.
Cougar, Mexican, 162.
Covillea tridentata, distribution of, 25.
Coyote, Mearns, 177.
  plains, 174.
  small-toothed, 178.
  Texas, 175.
Crassina grandiflora, 97.
Cratogeomys castanops, 132–133.
Creosote bush, 25.
Crotalus atrox, 49.
  confluentus, 50.
  horridus, 39, 49.
Crotalus lepidus, 51.
  molossus, 50.
Crotaphytus collaris, 39.
  collaris baileyi, 40.
  reticulatus, 40.
  wislizenii, 40.
Cynomys ludovicianus, 89–92.
Cyrtonyx mearnsi, 33.
Dasylirion texanum, 31, 66.
Dasypterus intermedius, 213.
Dasypus novemcinctus var. *mexicanus*, 52.
Daubentonia longifolia, 17, 20.
Deer, gray mule, 65.
  plains white-tailed, 63.
  Sonora, 64.
  Texas white-tailed, 60.
  white-tailed, 61.
Diadophis regalis, 45.
Didelphis marsupialis texensis, 57–58.
  virginiana, 56–57.
  virginiana pigra, 19, 57.
Diospyros virginiana, 32.
Dipodomys elator, 148–149.
  merriami, 149–150.
  merriami ambiguus, 150.
  spectabilis, 113, 147, 148.
Drymarchon corais melanurus, 47.
Drymobius margaritiferus, 46.
Elaps fulvius, 39, 48.
Ephedra trifurcata, 74.
Erethizon epixanthum, 150–151.
Eumeces brevilineatus, 45.
  guttulatus, 45.
  obsoletus, 45.
  quinquelineatus, 45.
Eustoma, 19.
Eutainia cyrtopsis, 48.
  elegans marciana, 39, 48.
  proxima, 48.
Eutamias cinereicollis canipes, 81.
Fallugia paradoxa, 33.
Felis apache, 167.
  cacomitli, 167–169.
  coryi, 163.
  couguar, 163.
  eyra, 167.
  hippolestes aztecus, 162–163.
  onca, 163.
  onca hernandezi, 163–166.
  pardalis, 166.
  pardalis limitis, 166–167.
  yaguarundi, 167.
Ferret, black-footed, 197.
Fiber zibethicus, 120–121.
  zibethicus ripensis, 121–122.
Flying squirrel, Florida, 79.
Fox, Florida gray, 182.
  gray, 180.
  kit, 179.
  New Mexico desert, 179.
  red, 178.
Fox squirrel, Louisiana, 75.
  western, 75.
  Texas, 77.
Garrya lindheimeri, 33.
  wrighti, 74.
Gecko, 44.

PLATE I.



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KENTUCKY
TENNESSEE
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
MISSISSIPPI

- Manfreda maculosa, 18, 24.
- Massasauga, 49.
- Megaquiscalus, 17.
- Mephitis mesomelas, 200-201.
  - mesomelas varians, 201, 202.
- Meriolix, 19.
- Merriam elk, 60.
- Mesophytic plant region, 23.
- Mesquite, 31.
- Microrhamnus, 88.
- Microtus ludovicianus, 19, 119-120.
  - mexicanus guadalupensis, 119.
  - pinetorum auricularis, 120.
- Mimosa biuncifera, 33.
- Mink, large brown, 196.
  - southeastern, 196.
- Mole, eastern, 205.
  - plains, 207.
  - Texas, 206.
- Momesia pallida, 24, 104, 157, 195.
- Monarda, 19.
- Morella cerifera, 20.
- Mormoops megalophylla senicula, 216.
- Mountain lion, 162.
  - sheep, 70-75.
- Mouse, grasshopper, 93.
  - harvest, 104, 105, 106.
  - house, 92.
  - pocket, 135, 137, 138, 139, 140, 141, 142, 143.
  - white-footed, 94, 95, 96.
- Mus alexandrinus, 93.
  - musculus, 92.
  - norvegicus, 92.
  - rattus, 92.
- Musk hog, 58.
- Muskrat, 120.
  - Pecos River, 121.
- Myotis californicus, 209.
  - incautus, 209-210.
  - velifer, 208.
  - yumanensis, 210.
- Nasua narica yucatanica, 14, 192.
- Natrix clarkii, 47.
  - fasciata transversa, 47.
- Neotoma albigula, 113-114.
  - floridana attwateri, 110-111.
  - floridana baileyi, 109-110.
  - floridana rubida, 107-109.
  - mexicana, 114.
  - micropus, 111-113.
- New species of mammals, 10-11.
- Nolina lindheimeriana, 65.
  - texana, 33.
- Notiosorex crawfordi, 207.
- Numenius longirostris, 33.
- Nuttallornis borealis, 38.
- Nycticeius humeralis, 213.
- Nyctinomus mexicanus, 215.
- Ocelot, 14, 166.
- Odocoileus couesi, 61, 64-65.
  - hemionus, 65.
- Odocoileus hemionus canus, 65-67.
  - louisianæ, 61.
  - virginianus, 61-63.
  - virginianus macrourus, 63-64.
  - virginianus texanus, 60-63, 64.
- Onychomys leucogaster pallescens, 93-94.
  - longipes, 93.
  - *torridus*, 94.
  - *torridus arenicola*, 94.
- Opheodrys æstivus, 46.
- Ophisaurus ventralis, 44.
- Opossum, Florida, 57.
  - Texas, 57.
  - Virginia, 56.
- Opuntia arborescens, 154.
  - cymochila, 33.
  - engelmanni, 24. 25, 75, 83, 84, 85, 86, 1 181, 195, 200, 208.
  - lepticaulis, 24.
  - macrorhiza, 87.
- Oryzomys aquaticus, 104.
  - palustris, 19, 103-104.
  - *palustris texensis*, 103.
- Otocoris leucolæma, 33.
- Otter, 195.
- Ovis mexicanus, 70-75.
- Padre Island, 20, 24.
- Panther, 162.
  - Adirondack, 163.
  - Florida, 163.
- Parabuteo u. harrisi, 112.
- Parkinsonia aculeata, 17, 24.
- Peccary, Texas, 58.
- Pedomys, 119.
- Pentstemon, 65, 75.
- Perodipus compactus, 20, 146, 147.
  - montanus richardsoni, 144-145.
  - ordi, 144.
  - sennetti, 145-146.
- Perognathus flavescens copei, 143.
  - flavus, 140-141.
  - hispidus, 135-137, 200.
  - hispidus paradoxus, 137-138.
  - hispidus spilotus, 138.
  - intermedius, 139-140.
  - merriami, 141-142.
  - merriami gilvus, 142-143.
  - nelsoni, 140.
  - nelsoni canescens, 140.
  - penicillatus eremicus, 138-139.
- Peromyscus, Attwater, 100.
  - attwateri, 100.
  - **boylei laceyi**, 11, 99-100.
  - *boylii penicillatus*, 98.
  - boylei rowleyi, 98.
  - *canus*, 96.
  - desert, 100.
  - eremicus, 100-101.
  - *eremicus arenarius*, 100.
  - frosted, 97.
  - gossypinus, 97-98.
  - Lacey, 99.
  - leucopus, 94-95.
  - leucopus mearnsi, 96.
  - leucopus texanus, 95-96.
  - little pale, 96.
  - michiganensis pallescens, 96-9
  - pine woods, 97.
  - Rowley, 98.
  - Sonoran, 97.
  - sonoriensis, 97.
  - sonoriensis blandus, 97.
  - taylori, 16, 19, 101-102.
  - **taylori subater**, 11, 17, 19, 102-103, 10
  - *tornillo*, 95.
- Persimmon, black, 32.
  - Japanese, 31.
  - Texan, 31.
  - yellow, 32.

U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF BIOLOGICAL SURVEY

NORTH AMERICAN FAUNA

No. 26

[Actual date of publication, November 24, 1906]

REVISION OF THE SKUNKS OF THE GENUS SPILOGALE

ARTHUR H. HOWELL
ASSISTANT BIOLOGIST, BIOLOGICAL SURVEY

Prepared [illegible]
Dr. C. HART MERRIAM
CHIEF OF BIOLOGICAL SURVEY

WASHINGTON
GOVERNMENT PRINTING OFFICE
1906

Sciurus rufiventer, 75.
    texianus, 77.
Screw bean, 31.
Semiarid Lower Sonoran, 23.
Sesban cavanillesii, 17.
Shrew, Carolina short-tailed, 207.
    Crawford, 207.
    eared shrew, 207.
    eastern, 207.
    least short-tailed, 208.
    Rio Grande short-tailed, 208.
Sigmodon hispidus berlandieri, 115, 117-118.
    hispidus pallidus, 117.
    hispidus texianus, 19, 114-117.
    ochrognathus, 115, 118.
Sistrurus catenatus consors, 49
Skink, 45.
Skunk, hog-nosed, 202.
    long-tailed Texas, 201.
    Louisiana, 200.
    prairie spotted, 199.
    Rio Grande spotted, 198.
    white-backed, 202.
Snake, blow, 46.
    coral, 48.
    garter, 48.
    glass, 44.
    hog-nosed, 45.
    king, 47.
    prairie bull, 47.
    ring, 45.
    rough green, 46.
    smooth green, 46.
    spotted garter, 48.
    striped water, 47.
    water, 47.
    whip, 46.
Snakes, 21, 28, 45-51.
    lizards and, 38.
Solanum triquetrum, 18.
Sonora deer, 64.
Sorex personatus, 207.
Sotol, 31.
Spilogale indianola, 19, 199, 200.
    interrupta, 199-200.
    leucoparia, 198-199.
Spotted skunk, prairie, 199.
    Rio Grande, 198.
    gulf, 200.
Squirrel, gray, 78.
    Louisiana fox, 75.
    pine, 79.
    spotted sand, 88.
    Texas antelope, 81.
    western fox, 75.
Storeria dekayi, 39, 48.
Suaeda, 88.
Swamp rabbit, 160.
    Attwater, 161.
Swift, 179.
Tamaulipan subdivision of Lower Sonoran, 14.
Tantilla gracilis, 48.
Tatu novemcinctum mexicanum, 53.
    novemcinctum texanum, 11, 52-56.
Tatusia mexicana, 52.
Taxidea taxus berlandieri, 184-186.
Tayassu angulatum, 58-60.
Tecoma stans, 74.
Texas palm, 15.
Thomomys aureus lachuguilla, 134-135.
    baileyi, 134.
    fulvus, 133.
    fulvus texensis 133-13
    perditus, 135.
Tillandsia baileyi, 18.
    recurvata, 24, 104.
Transition zone, 36.
    birds, 37.
    mammals, 36.
    plants of the Chisos Mountains, 38.
    plants of the Davis Mountains, 38.
    plants of the Guadalupe Mountains, 37.
Tropical elements of lower Rio Grande regio
Tropidoclonium lineatum, 39, 48.
Ungnadia speciosa, 110.
Upper Sonoran, 33.
    birds of, 34.
    lizards of, 35.
    mammals of, 34.
    plants of, 35.
    snakes of, 35.
Urocyon cinereoargenteus floridanus, 182.
    cinereoargenteus ocythous, 182.
    cinereoargenteus scotti, 180-182.
    cinereoargenteus texensis, 180.
Ursus americanus, 186-187.
    americanus amblyceps, 187-188.
    horribilis horriæus, 192.
    luteolus, 188-192.
Uta ornata, 41.
    stansburiana, 41.
Vachellia farnesiana, 17, 20, 24.
Vespertilio fuscus, 211.
Vireo plumbeus, 33.
    stephensi, 33.
Vole, bluegrass, 120.
    Guadalupe, 119.
    Louisiana, 119.
Vulpes fulvus, 178.
    macrotis neomexicanus, 179.
    velox, 179.
Water moccasin, 49.
Weasel, bridled, 198.
    New Mexico bridled, 198.
White-footed mouse, 94.
    Mearns, 96.
    Texas, 95.
Wildcat, plateau, 170.
Whooping crane, 24.
Wolf, black, 173.
    gray, 171.
    Texan red, 174.
Wood ibis, 24.
Wood rat, Attwater, 110.
    Baird, 111.
    Mexican, 114.
    Nebraska, 109.
    swamp, 107.
    white-throated, 113.
Xerophytic plant region, 23.
Yucca baccata, 33.
    glauca, 33.
    macrocarpa, 66.
    stricta, 85.
    treculeana, 18.
Zizyphus obtusifolia, 24, 181.

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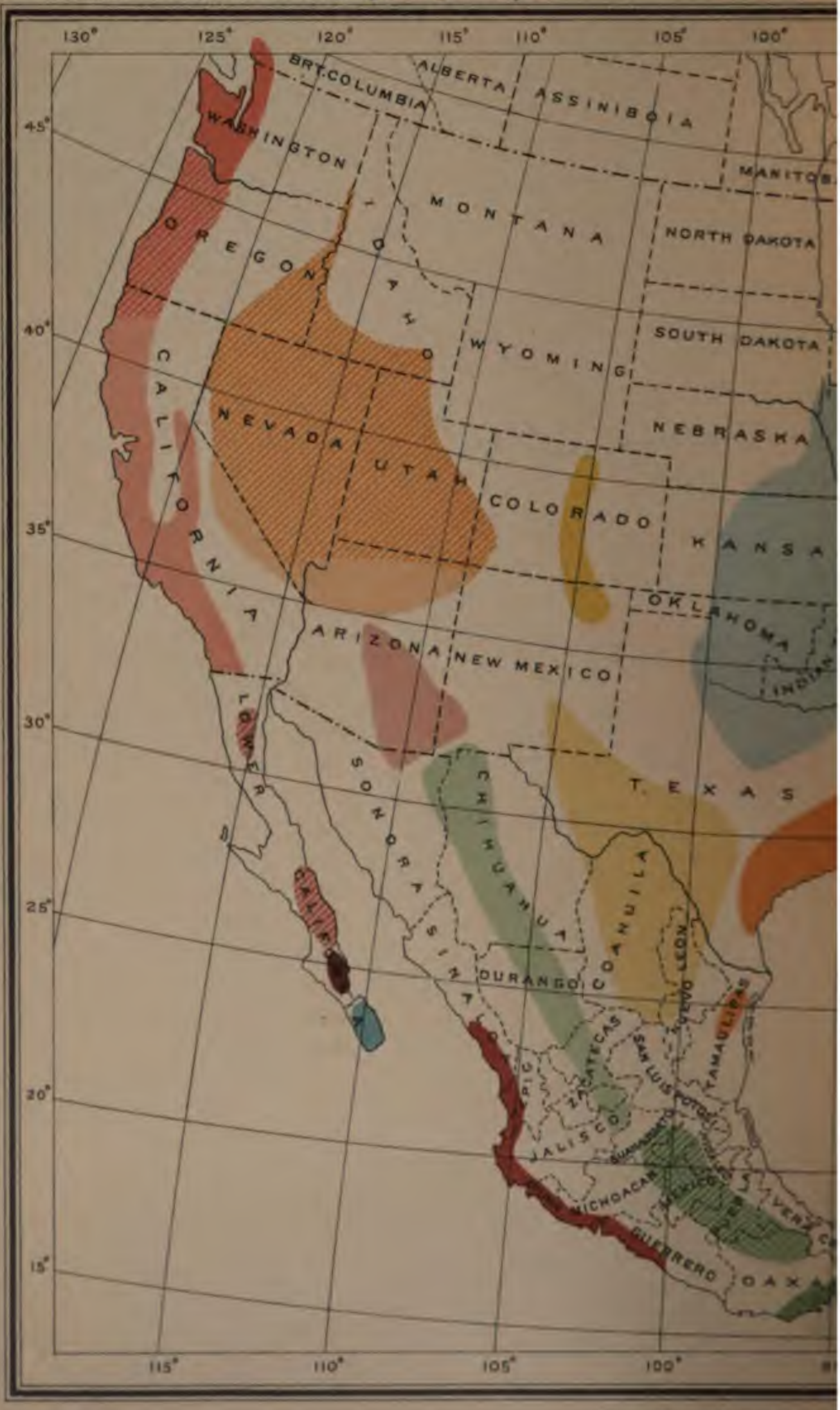

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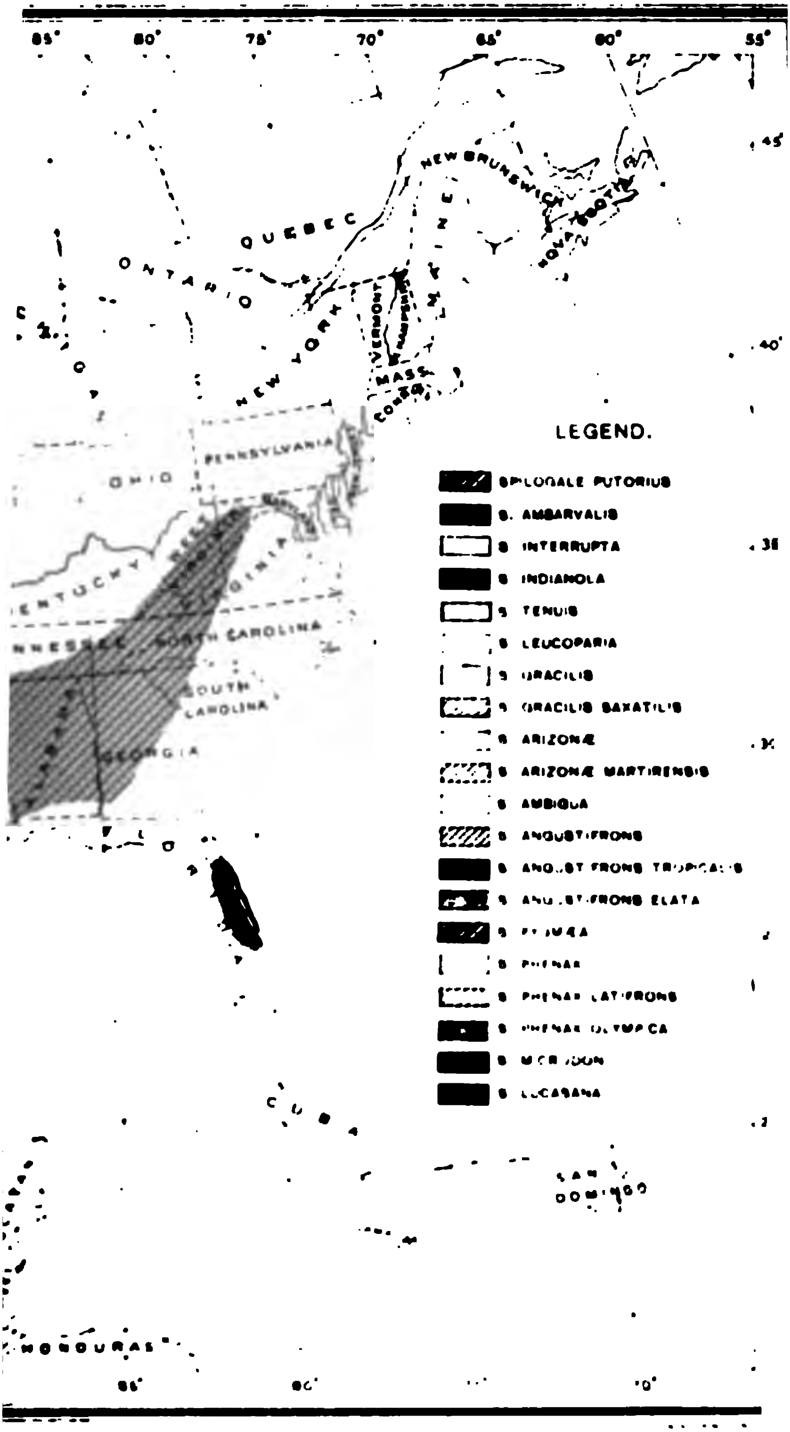
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CUBA
SAN DOMINGO
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85°
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LEGEND.
SPILOGALE PUTORIUS
S. AMBARVALIS
S. INTERRUPTA
S. INDIANOLA
S. TENUIS
S. LEUCOPARIA
S. GRACILIS
S. GRACILIS SAXATILIS
S. ARIZONÆ
S. ARIZONÆ MARTIRENSIS
S. AMBIGUA
S. ANGUSTIFRONS
S. ANGUSTIFRONS TROPICALIS
S. ANGUSTIFRONS ELATA
S. PYGMÆA
S. PHENAX
S. PHENAX LATIFRONS
S. PHENAX OLYMPICA
S. MICRODON
S. LUCASANA

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WASHINGTON
GOVERNMENT PRINTING OFFICE
1906

LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Biological Survey,
Washington, D. C., July 25, 1906.

Sir: I have the honor to transmit for publication as North American Fauna No. 26, a Revision of the Skunks of the genus *Spilogale*, by Arthur H. Howell, Assistant.

Respectfully,

C. Hart Merriam,
Chief, Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

CONTENTS.

Page.

Introduction 5
  History and material 5
  Distribution 7
  Habits 7
  Food 8
  External characters 9
  Nomenclature 10
    Generic names 10
    Specific names 11
enus *Spilogale* 12
  Generic characters 12
  Key to species and subspecies 12
  List of species and subspecies, with type localities 13
  Descriptions of species and subspecies 14
  Table of cranial measurements 36

ILLUSTRATIONS.

Pa
PLATE I. Map of the distribution of genus *Spilogale*................ Frontispie
II. Skins of *Spilogale putorius*, *S. interrupta*, and *S. leucoparia*.......
III. Skins of *Spilogale phenax* and *S. p. olympica*......................
IV. Skins of *Spilogale ambarvalis*, *S. angustifrons*, and *S. pygmæa*.....
V. Skulls of *Spilogale ambarvalis*, *S. putorius*, and *S. indianola* ......
VI. Skulls of *Spilogale leucoparia*, *S. tenuis*, and *S. gracilis*...........
VII. Skulls of *Spilogale phenax* and *S. p. latifrons*......................
VIII. Skulls of *Spilogale ambigua*, *S. arizonæ*, and *S. a. martirensis*.....
IX. Skulls of *Spilogale angustifrons*, *S. a. tropicalis*, and *S. a. elata*....
X. Skulls of *Spilogale lucasana*, *S. microdon*, and *S. pygmæa* ....

No. 26. NORTH AMERICAN FAUNA. November, 1906.

REVISION OF THE SKUNKS OF THE GENUS SPILOGALE.

By Arthur H. Howell,
Assistant Biologist.

INTRODUCTION.

HISTORY AND MATERIAL.

The little spotted skunks were apparently known to naturalists as early as the middle of the seventeenth century, but for many years they were confused with other groups of ill-smelling animals, and not until the early part of the nineteenth century (in the time of Gray and Lichtenstein) did their characters and habitat become definitely known.

Hernandez, in 1651, referred to a variety of the Mexican "*ysquiepatl*" having many white stripes, and this probably is the first mention in literature of the spotted skunks.[a]

The first account of a United States species is that given by Catesby in his 'Natural History of Carolina,' published in 1743. His description of the 'pol-cat' of Carolina was very inaccurate, but as I have elsewhere shown[b] was undoubtedly drawn from personal observation of a spotted skunk. This description was made the chief basis of the first scientific name applied to any member of the group—*Viverra putorius* Linnæus, 1758.

Buffon, in 1765, copied Catesby's figure, and attached to it the appellation '*le Conepate*.' Another species, which he called '*le Zorille*,' was described from a specimen in the cabinet of a curate in Paris; this was doubtless the first specimen of *Spilogale* to find its way into the hands of any naturalist, and the figure with the accompanying description furnishes the first accurate portrayal of any species of the genus. Buffon wrongly ascribed the species to South America, and this error was not corrected for many years. Schreber, in 1776, copied Buffon's description and figure, and latinized the vernacular[c] name into *Viverra zorilla*.

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[a] Thesaurus Rer. Med. Novae Hisp., p. 332.

[b] Proc. Biol. Soc. Wash., XV, pp. 241-242, 1902.

[c] A modification of '*zorilo*,' the vernacular name of the skunks in Mexico.

Little advance was made in the study of the spotted skunks for the next half century. The species described by Buffon and Schreber became confused with the South African '*muishond*'—a four-striped black and white animal having the ill-smelling qualities of a skunk, but belonging to a quite different group—and it was not until Lichtenstein published his monograph of the skunks in 1838 that the mistake was corrected. In this paper only two species of spotted skunks—*Mephitis zorilla* and *M. interrupta*—were recognized, the latter having been described in 1820 by Rafinesque. Gray, in 1837, proposed *Mephitis bicolor* as a new species, but in his revision of the *Mustelidæ*, published in 1865,[a] adopted *interrupta* instead, placing both *bicolor* and *zorilla* under it as synonyms. As early as 1837 he pointed out some of the characters which distinguish the spotted skunks, and placed his *M. bicolor* in a subdivision by itself; but not until 1865, when he proposed *Spilogale*, was the genus provided with a name. The practice of 'lumping' all the forms of the genus under one name was continued by most later authors, Baird in his 'Mammals of North America' using the name *bicolor*, and Coues[b] in his monograph of the family reviving the Linnæan name *putorius* for the species collectively; and it was not until 1890, when Doctor Merriam published his preliminary revision of the genus,[c] that an adequate attempt to define the species was made. The total number of specimens available for study at that time was only 39 skins and 38 skulls, but in spite of the meagerness of the material 10 species and subspecies were recognized, 8 of which were described as new. All of these are retained in the present paper, and in addition eight more forms described since 1890 are recognized. One species and one subspecies (*Spilogale microdon* and *S. angustifrons elata*), are herein described as new, bringing the total number of known forms up to 20.

The present revision is based on a study of about 380 skins with skulls and 75 additional skulls. The bulk of this material is in the collection of the Biological Survey, but this has been supplemented by additional specimens from the collections of the U. S. National Museum, and the American Museum of Natural History, and the private collection of Dr. C. Hart Merriam. The author acknowledges gratefully his obligation to the following gentlemen for the loan of valuable material from the collections under their charge: To Dr. J. A. Allen and Mr. Frank M. Chapman, of the American Museum of Natural History; Mr. Gerrit S. Miller, jr., of the U. S. National Museum; and Dr. D. G. Elliot, of the Field Columbian Museum. To Dr. C. Hart Merriam I am indebted also for much valuable criticism.

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[a] Proc. Zool. Soc. London for 1865, p. 150.

[b] Fur-Bearing Animals, p. 239, 1877.

[c] N. Am. Fauna No. 4, pp. 1-16, 1890.

DISTRIBUTION.

The genus *Spilogale* has a much more restricted distribution than the genus *Mephitis*, and its affinities are decidedly southern. The northern limits of its range may be roughly indicated as follows: Northern Virginia, southern Minnesota, central Wyoming,[a] southern Idaho, southeastern Washington,[b] and southern British Columbia (Howe Sound). Most of the species are confined to the Sonoran or Austral zones, but a few (*S. phenax* and its subspecies, *S. putorius* and *S. tenuis*) occur in the Transition, and two (*S. tropicalis* and *lucasana*) in the Tropical.

To the southward the genus spreads over the greater part of Mexico, including Lower California, and reaches Yucatan,[c] Guatemala,[c] and Costa Rica. In the latter region, according to Mr. George K. Cherrie, it is very rare.

The members of this genus are much less uniformly distributed than the large skunks (*Mephitis*),-and are absent from extensive areas where they might be expected to occur. No species, so far as known, occupies the coastal plain of eastern Mexico, from Tamaulipas to Yucatan. Spotted skunks are likewise absent or very rare in the coastal region of Georgia and the Carolinas, although occurring much farther north along the Alleghenies.

HABITS.

The little spotted skunks are more agile than the large skunks of the genus *Mephitis*, and, unlike the latter, often climb bushes and small trees. Most of the species prefer rocky situations, and whenever they are available make their homes in rock piles or crevices in cliffs. On the Northwest Coast they live in hollow logs or stumps, and on the prairies of southern Texas are found under patches of cactus and mesquite. Some species live in brushy river bottoms, and these occasionally dig burrows for themselves, though more frequently they occupy deserted burrows of other animals. A den examined by the writer in South Carolina consisted of a burrow dug beneath the roots of a fallen tree. The habit of digging small holes in the ground in search of insects is attested by several observers. Dr. W. L. Ralph tells me that in Florida spotted skunks are often found occupying the burrows made by burrowing owls (*Speotyto c. floridana*), and the supposition is that they had made way with the original occupants, or at least with their eggs. Both the Florida species and the Pacific Coast forms are known to frequent ocean beaches. The spotted skunks frequently take up their abode under houses or outbuildings, and have been known to come boldly into occupied dwellings. They are strictly nocturnal in habit, and therefore are rarely seen afield except on moonlight nights. Dr. C. Hart Merriam tells me that when moving about in the moonlight their markings blend with the lights and shadows in such a way as to render the animals very inconspicuous.

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[a] Merritt Cary, of the Biological Survey, tells me that *Spilogale* is reported by sheep herders as occurring on the Caspar plains north of Douglas, Wyoming. He also reports that several spotted skunks were killed in the Black Hills, near Elk Mountain, South Dakota, in 1902 and 1903.

[b] I am informed by S. E. Piper, of the Biological Survey, that he captured two specimens of *Spilogale* at Almota, Washington, in the Snake River canyon, in 1897. These specimens can not now be found, so that their identity can not be determined, but they probably are referable to the Great Basin form, *S. gracilis saxatilis*. Although the genus reaches British Columbia on the Pacific coast, Almota is the most northerly place in the interior from which it has been recorded.

[c] Recorded by Alston in Biologia Centrali Americana, but no specimens from these regions have been examined.

The fluid secreted by the anal glands and used as a means of defense possesses the same properties as that of the allied genera,[a] and is of equally disagreeable odor.[b]

In many parts of the West these skunks are known as 'hydrophobia cats' and are greatly dreaded on account of the prevalent notion that their bite produces rabies. While there are a few authentic cases of skunk bite having resulted fatally,[c] there are also many instances in which it has produced no ill effect whatever. The recorded cases of skunk rabies are nearly all from the plains region of the West (Kansas, Texas, and Arizona) and relate more to *Mephitis* than to *Spilogale*. The most plausible explanation of these facts seems to be that at certain periods rabies may become locally epidemic among dogs and wolves, and by them be communicated to skunks.

FOOD.

The food of the spotted skunks, judged by the records of seventeen stomach examinations made by the collectors of the Biological Survey, consists in large measure of insects, chiefly beetles and grasshoppers. These are supplemented by mice and other small mammals, lizards, salamanders, small birds, and crayfish. One stomach contained persimmons and several species of fungus.

In some localities these skunks are known to destroy hens' eggs, and doubtless wild birds' eggs also are frequently eaten. Most of the reports received by the Biological Survey with reference to damage done in the poultry yard by the spotted skunks come from the Pacific Coast, where they are particularly abundant.

S. E. Piper, of the Biological Survey, examined a *Spilogale* den in the Holston Mountains, Tennessee, and found in it the remains of gray squirrels (*Sciurus carolinensis*). The capture of so large a al as a squirrel by these skunks is, however, unusual.

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[a] See N. Am. Fauna No. 20, pp. 12-13, 1901.

[b] I am informed by Dr. A. K. Fisher that a solution of chlorinated soda (Labarraque's fluid) is a highly effective agent in destroying the odor of the skunk's secretion.

[c] See Coues, Fur-bearing Animals, pp. 223-235, 1877.

spotted skunks doubtless do much good in destroying rats. Oberholser, of the Biological Survey, reports that at Port a, Texas, they are known to capture wood rats (*Neotoma*), which ure by following them into their runways. D. E. Lantz, also Biological Survey, has recorded an instance where a *Spilogal* d to be a valuable aid in destroying house rats and mice. He

> e there my family occupied for two years a house with large cellar openings [illegible] * * * The cellars, and in fact the entire house, were overrun [illegible]. A couple of months after we had first occupied the house I [illegible] striped skunk was present in the cellar. We could often hear [illegible] and rats, and I was careful not to disturb it when I went to the [illegible]. I often saw it in the cellar, and it did not seem to fear my presence. In a very few weeks we could hear no more of the fights with the rats, and rats and mice were either killed or driven from the place.*

Maynard, writing of the Florida species, says:

> Skunks are easily domesticated, and I have frequently known of their being [illegible] houses for the purpose of catching mice. Sometimes the animals are [illegible] and the scent glands removed, but they are often simply decoyed about the [illegible] exposing food, when they will take up their abode beneath the [illegible] become so tame as to enter the [illegible] apartments in search of [illegible]

orded observations on the food habits of the spotted skunks seem ate that while in regions where they are abundant they destroy or less poultry, the fact that their diet consists chiefly of injuri dents and insects entitles them to be considered valuable allies farmer, and their presence about the farm should be encouraged.

EXTERNAL CHARACTERS.

members of this genus are, with one exception, [illegible] f the species of *M* [illegible] like. The pads on both the [illegible] feet are [illegible] ar tubercles at the base of the toes. [illegible] somewhat finer [illegible] than that of *M* [illegible] the tail hairs are [illegible] In other respects, [illegible] pattern of [illegible] otted skunks externally are [illegible] to the [illegible]

Teats [illegible] being as follows: [illegible]

Kansas [illegible]

Essex Inst. [illegible]

Spilogale leuco [illegible]

[illegible]

smaller than [illegible] *M* [illegible]

Recorded observations as to the number of young produced at a birth are very meager. Two records furnished by collectors of the Biological Survey give the number of embryos as four and five, respectively.

Spilogale exhibits less variation in markings than does *Mephitis*. Most of the species are quite constant in the pattern of coloration, and only one (*interrupta*) shows a large amount of variation. The usual color pattern may be described as follows: Body and tail black; a more or less triangular white spot on the forehead between the eyes; four parallel white stripes on the upper parts, commencing between or slightly behind the ears, and extending to about the middle of the back; the outer one on each side continued forward under and in front of the ear; another white stripe on each side commencing just behind the foreleg and running parallel with the dorsal stripes and a short distance beyond them, where it curves up on to the back and almost or quite meets the median stripe on the corresponding side; between the ends of these two lateral stripes on the back are two narrow white patches in the same line with the median dorsal stripes. On the hinder part of the body, in front of the hips, are two transverse white bands reaching to the line of the median stripes; a small white patch on each side of the rump, sometimes continuous with a stripe on the thigh; a narrow white patch or stripe on each side of the tail at its base, usually confluent posteriorly; end of the tail usually white.

NOMENCLATURE.

GENERIC NAMES.

The synonymy of the genus *Spilogale* is not extensive, but since there has been considerable discussion with regard to the application of the generic name,[a] and as it is now established on a firm basis, it will be well to consider briefly its status and history. As stated in my paper on the large skunks,[b] the genus *Mephitis* of Cuvier (1800) included two species, *Viverra mephitis* and *V. putorius*, the latter being one of the spotted skunks. Lesson in 1842 made *V. mephitis* the type of the genus *Chincha*, thus restricting *Mephitis* Cuvier to the spotted skunks,[c] and it was on the basis of this restriction that I proposed to adopt the name *Mephitis* in place of *Spilogale* Gray, 1865. In making this change, and until quite recently, I was unaware that the genus *Mephitis* was first proposed by E. Geoffroy and Cuvier in 1795,[d] five years earlier s use by Cuvier in his '*Leçons d'Anatomie Comparée*,' which ays been quoted as the primary reference. As originally pro- in 1795, the genus *Mephitis* included only a single species, *mephitis* Schreber, and hence has no bearing on the spotted , which remained without a name until separated by Gray in the genus *Spilogale*.

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[a] See Allen, Bull. Am. Mus. Nat. Hist., XIV, pp. 325–334, 1901; Howell, Proc. Biol. Soc. Wash., XV, pp. 1–9, 1902; Allen, Proc. Biol. Soc. Wash., XV, pp. 59–66, 1902.

[b] N. Am. Fauna No. 20, p. 14, 1901.

[c] Nouv. Tabl. Regne Anim., Mam., p. 67, 1842.

[d] Mag. Encyclop. II (6), p. 187. *Mephitis* proposed for the 'Mouffettes'; *Viverra mephitis* the only species mentioned (p. 185). The correct citation is given in Sherborne's 'Index Animalium,' and has been verified for me in the Paris Library by Mr. G. S. Miller, jr.

SPECIFIC NAMES

few changes in the currently accepted names have been deemed ry, and it remains only to consider briefly those which have ound to be unavailable or which in the present paper are used s connection. These are as follows:

Mephitis Gray, 1837. Mag. Nat. Hist., I, p. 581.

name was proposed for a species said to inhabit North America. there are no diagnostic characters in the description the name e rejected as unidentifiable. It was used in a collective sense rd in 1857, and was applied to the Florida species by Allen in

ta *Viverra* Muller, 1776. Natursystems Suppl., p. 32.

species described under this name is based on the *Zorille* of , and the name is therefore a synonym of *Viverra* [illegible] [illegible]

Mephitis [illegible] Cuvier, 1798. Tabl. Elem. Hist. Nat. Anim., pp. 116, 1[illegible]

description under this name is clearly that of a spotted skunk. references show that the name is a synonym of *Viverra* [illegible] nn., for which it was evidently proposed as a substitute.

[illegible] *Mephitis* W[illegible] 18[illegible] [illegible]

name was published by Edgar W. W[illegible] [illegible] companied by an accurate description [illegible] It is a synonym of *M*[illegible] [illegible] Raf[illegible]

Spilogale Merriam, 18[illegible] N. Am. [illegible]

name was given to the species occupying the [illegible] Virginia gion of the United States. Later [illegible] that could bear the name [illegible] Linnaeus [illegible] consideration of this species [illegible] page [illegible]

[illegible]

species described [illegible] of which name [illegible]

Viverra Schreber [illegible]

species described under this name is clearly based on the *Z*[illegible] lon, since Schreber's plate is practically a copy of Buffon's, and his description likewise is abridged from Daubenton, Buffon's collaborator. Buffon states that his knowledge of the *zorille* was obtained from a specimen in the collection of M. Aubrey, a curate in Paris, and his figure shows evidence of having been drawn from an actual specimen, rather than from the descriptions of travelers. Under these circumstances it would be highly desirable to make use of the name if there were any way of determining to what species it applies. But unfortunately there is nothing in either the description or the figure by which it can be identified. Buffon erroneously ascribed the animal to South America, where the genus is not known to occur, and he was followed in this, as in other details, by Schreber. The picture resembles quite strongly both the Florida species, and the several forms of *Spilogale angustifrons* inhabiting Mexico. The specimen examined by Buffon may have come from either locality—more probably, it seems to me, from Mexico. Lichtenstein was the first author to use the name in a restricted sense, and his application of it to the California species[a] might be accepted were it not for the fact that at the time of the publication of Buffon's description California was not inhabited by civilized peoples; the possibility that his specimen was received from there is therefore very remote. In view of the uncertainty attaching to this name, and since all the known species are now supplied with names, it seems best to reject it altogether.

Genus SPILOGALE Gray.

Spilogale Gray, Proc. Zool. Soc. London, 1865, p. 150. Type, *Mephitis interrupta* Rafinesque.

Generic characters.—Skull flattened, with rostrum only slightly depressed below plane of upper surface; periotic region and audital bullæ greatly inflated; mastoid and paroccipital processes obsolete or very small; postorbital processes well developed; 'step' in lower jaw not pronounced (sometimes lacking); tube of auditory meatus directed forward; zygomata highly arched, with the highest point at the middle of the arch; antero-posterior diameter of upper molar less than transverse diameter. Dental formula: $i. \frac{3-3}{3-3}$; $c. \frac{1-1}{1-1}$; $pm. \frac{3-3}{3-3}$; $m. \frac{1-1}{2-2} = 34$.

Key to Species and Subspecies.

(Based on adult males.)

Dorsal stripes not broken into patches on hinder parts........................*pygmæa*
Dorsal stripes broken into patches on hinder parts.
  Upper molar with greatest convexity *near middle* of tooth.
    Tail without prominent white tip (usually wholly black).............*interrupta*
    Tail with prominent white tip.
      Size larger; mastoids greatly inflated................................*putorius*
      Size smaller; mastoids not greatly inflated.........................*indianola*

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[a] *Abhand.* Akad. Wiss. Berlin for 1836, p. 282, 1838. Specimens collected by Deppe at Monterey.

- **Upper molar with greatest convexity *behind middle* of tooth.**
  - **Cranium relatively narrow and high.**
    - **Rostrum narrower** (**interorbital breadth less than 13.5 mm.**)......*angustifrons*
    - **Rostrum broader** (**interorbital breadth more than 13.5 mm.**)
      - **Teeth lighter.**
        - **Size large** (**interorbital breadth more than 15 mm.**)..............*microdon*
        - **Size small** (**interorbital breadth less than 15 mm.**)..............*tropicalis*
      - **Teeth heavier.**
        - **Skull long and narrow**..*elata*
        - **Skull short and wide.**
          - **White patches at base of tail small** (about 30 mm. in length)..*ambigua*
          - **White patches at base of tail large** (about 50 mm. in length).*ambarvalis*
  - **Cranium relatively broad and flat.**
    - **Mastoids greatly inflated**..*leucoparia*
    - **Mastoids not greatly inflated.**
      - **Black markings predominating.**
        - **Rostrum broader** (**interorbital breadth more than 17 mm.**).......*latifrons*
        - **Rostrum narrower** (**interorbital breadth less than 17 mm.**) ......*olympica*
      - **White markings predominating.**
        - **Skull larger; dentition heavy.**
          - **Size larger** (**mastoid breadth over 35 mm.**)..................*lucasana*
          - **Size smaller** (**mastoid breadth under 35 mm.**)..................*phenax*
        - **Skull smaller; dentition light.**
          - **Zygomata broadly expanded and highly arched.**
            - **Rostrum narrower** (**interorbital breadth about 12.5 mm.**)..*martirensis*
            - **Rostrum broader** (**interorbital breadth about 15 mm.**) ....*arizonæ*
          - **Zygomata not broadly expanded nor highly arched.**
            - **Skull longer** (**basilar length of Hensel 51–52 mm.**).............*tenuis*
            - **Skull shorter** (**basilar length of Hensel 47–50 mm.**).
              - **Postorbital processes well developed; lateral stripe reduced**.*saxatilis*
              - **Postorbital processes not well developed; lateral stripe prominent** ....*gracilis*

List of Species and Subspecies, with Type Localities.

Spilogale ambarvalis **Bangs**	Micco, Florida.
putorius (**Linnæus**)....................	South Carolina.
interrupta (**Rafinesque**)..............	"Upper Missouri" River.
indianola **Merriam**	Indianola, Texas.
leucoparia **Merriam**..................	Mason, Texas.
tenuis **Howell**	Arkins, Colorado.
gracilis **Merriam**	Grand Canyon, Arizona.
gracilis saxatilis **Merriam**............	Provo, Utah.
ambigua **Mearns**......................	Eagle Mountain, Chihuahua.
angustifrons **Howell**	Tlalpam, Federal District, Mexico.
angustifrons tropicalis **Howell**.........	San Mateo del Mar, Oaxaca.
angustifrons elata **nobis**	San Bartolomé, Chiapas.
pygmæa **Thomas**	Rosario, Sinaloa.
arizonæ **Mearns**	Fort Verde, Arizona.
arizonæ martirensis **Elliot**	San Pedro Martir Mountains, Lower California.
phenax **Merriam**	Nicasio, California.
phenax latifrons **Merriam**.............	Roseburg, Oregon.
phenax olympica **Elliot**...............	Olympic Mountains, Washington.
microdon **nobis**......................	Comondú, Lower California.
lucasana **Merriam**.....................	Cape St. Lucas, Lower California.

Descriptions of Species and Subspecies.

SPILOGALE AMBARVALIS Bangs. Florida Spotted Skunk.

Mephitis bicolor Allen, Bull. Mus. Comp. Zool., II, p. 169, 1871.

Spilogale putorius Coues, Bull. U. S. Geol. and Geog. Surv. Terr., 2d ser., No. 1, p. 12, 1875 (part); Merriam, N. Am. Fauna, No. 4, p. 7, 1890. (Not *Viverra putorius* Linn.)

Mephitis (*Spilogale*) *putorius* Coues, Fur-Bearing Animals, p. 239, 1877 (part).

Spilogale ambarvalis Bangs, Proc. Boston Soc. Nat. Hist., XXVIII, p. 222, 1898.

Type locality.—Oak Lodge, opposite Micco, Brevard County, Florida.

Geographic distribution.—Eastern portion of peninsular Florida, from New Smyrna south to Lake Worth.

General characters.—Size small; *tail very short; white markings extensive;* skull short and broad, with highly arched cranium.

Color.—White markings extensive, the white dorsal stripes about equaling in width the intervening black areas; median pair of dorsal stripes little, if any, narrower than outer pair; lateral stripes[a] very broad; frontal spot large; white patch in front of ear large, and always continuous with outer dorsal stripe; tail with terminal third above and terminal half below, white; a large white patch, roughly U-shaped, on upper surface of tail near base. White patches sometimes occur on the thighs, and others on the upper surfaces of the hind feet, but these markings are not constant.

Cranial characters.—Skull short and broad; brain case relatively high and narrow; fronto-parietal region elevated above plane of upper surface; postorbital processes well developed; interorbital constriction slight; mastoid capsules moderately and audital bullæ greatly inflated; zygomata spreading in an even curve and never widely expanded; upper molar and sectorial tooth small, *the former with projection of inner lobe considerably behind middle of tooth.*

Measurements.—Eight adult males from type locality: Total length, 356–407; tail vertebræ, 106–134; hind foot, 37–43; average, 374; 120; 40. Average of 5 adult male topotypes, as measured by Bangs, 383.8; 143.5; 41.1. Average of 5 adult females from type locality,[b] 354.6; 121.2; 38.8. Skull: (See table, p. 36.)

General remarks.—This species is confined, so far as known, to the east side of the Florida peninsula, where, according to Bangs, it is locally distributed.[c] Its occurrence there was first made known to science in 1871, when Dr. J. A. Allen recorded its discovery by Mr. C. J. Maynard several years previously.[d] Up to that time the

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[a] The term 'lateral stripes,' as used in this paper, refers to the white stripes which begin behind the foreshoulders and extend along the sides, parallel to the dorsal stripes, to a point somewhat beyond the middle of the body, where they continue transversely to the middle of the back.

[b] *Fide* Bangs.

[c] Proc. Boston Soc. Nat. Hist., XXVIII, p. 224, 1898.

[d] Bull. Mus. Comp. Zool., II, p. 170, 1871.

[illegible] of any species of *Spilogale* east of the Mississippi Valley [illegible] suspected. Maynard, in 1872, gave its probable distribution as extending from New Smyrna to Jupiter Inlet,[a] and later investigations [illegible] largely confirmed this range.

[illegible] species, as I am informed by Mr. Frank M. Chapman and Dr. [illegible] Ralph, lives in holes in the sand, both in the scrub palmetto [illegible] coast and in dry pine barrens farther inland.

[illegible] Merriam, in his preliminary revision of the genus,[b] applied [illegible] name *putorius* to this species on the assumption that Catesby's description, on which the name was primarily based, might have [illegible] from either the Florida or the Carolina animal. Bangs has [illegible] this application of the name, chiefly on the ground that [illegible] given by Linnaeus "*cauda longitudine corporis*" is not applicable to the Florida animal, which has a tail about half as long as [illegible]. The present writer has examined the evidence on this [illegible] with much care, and the reasons for applying the name *putorius* [illegible] Carolina rather than to the Florida animal will be found under [illegible] next species (p. 16).

The Florida spotted skunk is a strongly characterized form, easily recognizable by its small size and extensive white markings. In skull characters it most nearly resembles the group of species occupying the Mexican tableland. Its range, however, is entirely cut off from the [illegible] of the Mexican forms by that of S. [illegible], which occupies [illegible] region of southern Texas.

Specimens examined. Total number [illegible], from the following [illegible]:

Florida: [illegible] Lodge, opposite Mi[illegible] [illegible]
[illegible] Cape Canaveral [illegible]

[illegible] SPILOGALE PUTORIUS [illegible]

[illegible]

[illegible] Merriam [illegible]

Type locality.—South Carolina.

Geographic distribution.—M[illegible] South Carolina, [illegible] Virginia, [illegible]

[illegible] skull [illegible]

[illegible] White [illegible]

[illegible] medium [illegible]

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[a] Bull. Essex [illegible]
[b] N. Am. [illegible]
[c] Proc. Biol. [illegible]

rarely interrupted; white patch on forehead and one in front of ear small, often not continuous with outer dorsal stripe; tail with a large white patch at tip, occupying one-fourth to one-half of upper surface.

Cranial characters.—Skull long and relatively narrow; *dentition heavy;* cranium highly arched; fronto-parietal region elevated, but much less so than in *ambarvalis;* postorbital constriction marked; postorbital processes well developed; zygomata not broadly expanded, but nearly parallel to axis of skull; mastoids and audital bullæ large; anterior border of inter-pterygoid fossa scarcely reaching plane of the posterior border of molars; *upper molar evenly rounded on inner side, with projection near middle of tooth.*

Measurements.—Seven adult males from Greensboro, Alabama: Total length, 470–563; tail vertebræ, 193–219; hind foot, 45–51; average: 512; 204; 47.5. Six adult females from same locality: Total length, 437–544; tail vertebræ, 166–204; hind foot, 38–45; average: 482; 189; 42. Skull: (See table, p. 36.)

General remarks.—This species was characterized by Doctor Merriam in 1890, under the name *ringens*, from specimens collected at Greensboro, Alabama. The present writer has already shown in some detail that the Linnæan name *putorius*, based on the 'pol-cat' of Catesby, is strictly applicable to this species,[a] and not to the Florida species, on which it was fixed by Doctor Merriam. It is unnecessary to repeat all of the evidence here, but since additional light on the question has recently been obtained, a statement of the reasons for applying this name to the Carolina, instead of to the Florida species, is deemed advisable.

In October, 1905, the writer visited South Carolina in order to determine what species of *Spilogale* occurs in the region where Catesby traveled. Two localities in the coastal plain of that State were visited—Hardeeville, Beaufort County, and Robertsville, Hampton County. Apparently *Spilogale* does not occur in this region, since the animal is unknown to the residents, and careful trapping with the aid of a local hunter failed to secure a specimen. Proceeding next to Cleora, in the rough hill country of Edgefield County, definite evidence of the occurrence of *Spilogale* there was obtained. Local hunters reported that the small 'polecats,' as they are called, were frequently chased by dogs while hunting at night, and their statement that the skunks take refuge in trees makes it certain that *Spilogale* is the animal referred to. The writer was shown a den dug beneath the roots of a fallen tree in a wooded hollow, and a *Spilogale* tail was picked up near by. None of the animals were secured at this time, but in January of the present year a specimen in the flesh was sent to the Biological Survey from Cleora, thus affording definite data for the determination of Catesby's animal, which proves to be the same as *Spilogale* ***ringens*** of Merriam.

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[a] Proc. Biol. Soc. Wash., XV, pp. 2–6, 1902.

[illegible]ality where this specimen was collected is well within the [illegible] Catesby's journeyings, for he tells us that he remained for [illegible] at and about *Fort Moore*, a small Fortress on the Banks [illegible] River *Savanna*, which runs from thence a Course of 300 Miles [illegible] Sea, and is about the same Distance from its Source, in [illegible] Mountains."

[illegible] for fixing the name *putorius* upon this species may be [illegible] as follows:

As [illegible] above, the only species of *Spilogale* known to occur [illegible] region traversed by Catesby is the Alleghenian species, S. [illegible] Merriam.

2. [illegible] that Catesby ever [illegible] peninsular Florida is [illegible] the title of his work and on his statement that he [illegible] almost three years in [illegible] and the adjacent parts [illegible] Spaniards call *Florida*, particularly that Province lately [illegible] with the name of *Georgia*." It seems highly probable that [illegible] made a journey to the region south of St. Augustine, the present habitat of the Florida spotted skunk, he would have given some [illegible] of the trip in his itinerary, as he did in the case of his expedition [illegible] Bahamas.

In [illegible] description of the "pol[illegible]," Catesby says: "[illegible] hollow Trees and Ro[illegible]." [illegible] the [illegible] of the [illegible] could [illegible] species, since the [illegible] original [illegible] length of the [illegible] Carolina [illegible] Florida sp[illegible]

[illegible] related to [illegible] Mississippi Valley [illegible] occurs [illegible] However, [illegible] Oklahoma [illegible] Mississippi R[illegible]

West Virginia: [illegible]

Virginia: [illegible]

Tennessee: [illegible]

[illegible]

North Carolina: Roan Mountain, 1; Magnetic City (foot of Roan Mountain), 8; Valley River, Cherokee County, 1.
South Carolina: Cleora, Edgefield County, 1.
Georgia: Mimsville, 1.
Alabama: Greensboro, 18; Mobile, 1.
Mississippi: Corinth, 1.

SPILOGALE INTERRUPTA (Rafinesque). PRAIRIE SPOTTED SKUNK.

Mephitis interrupta Rafinesque, Annals of Nature, I, p. 3, 1820; Lichtenstein, Abhand. Akad. Wiss. Berlin for 1836, p. 281, Tab. II, fig. 1, 1838.
Mephitis quaterlinearis Winans, [Kansas?] newspaper, 1859 (see Coues, Fur-Bearing Animals, pp. 239–240, 1877).
Spilogale interrupta Merriam, N. Am. Fauna No. 4, p. 8, 1890.

Type locality.—"Upper Missouri" River.

Geographic distribution.—Iowa, southern Minnesota, Nebraska, Kansas, Missouri, and Oklahoma; south in eastern Texas to about the middle of the State.

General characters.—Resembling *S. putorius*, but with much more black; tail without prominent white tip.

Color.—White markings much reduced; dorsal stripes variable in width, but averaging narrower than in *putorius*, frequently interrupted (in about one-third of the specimens examined) and sometimes reduced to a few widely separated spots; median pair usually narrower than outer pair; white patch on forehead small, often a mere speck; patch in front of ear much reduced, often absent, and usually not continuous with outer dorsal stripe; *tail usually wholly black*, but occasionally with a very slender tuft of white hairs at the tip, entirely surrounded by the black hairs.

Cranial characters.—Skull closely resembling that of *S. putorius*, but averaging shorter, and relatively broader; *rostrum narrower;* mastoid capsules only slightly inflated, *but with well-developed processes;* upper molar as in *putorius*.

Measurements.—Eight adult males from Kansas, Nebraska, Iowa, and Oklahoma: Total length, 490–536; tail vertebræ, 181–223; hind foot, 44–51; average: 515; 210; 48.5. Average of two females from Cairo, Kansas: 473; 170; 42.5. Skull: (See table, p. 36.)

General remarks.—Doctor Merriam has shown the pertinence of the name *interrupta* to this species,[a] and it is unnecessary to repeat the evidence here. The species may be readily recognized by its black tail. Specimens from the Wichita Mountains, Oklahoma, are intermediate in skull characters between *interrupta* and *putorius*. Externally they agree with *interrupta*. Intergradation with *indianola* probably takes place in central or southern Texas, though the material at hand is not sufficient to show this clearly.

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[a] N. Am. Fauna No. 4, p. 9, 1890.

The southern and western limits of the range of *interrupta* are not accurately known, and only recently it has been ascertained to reach the southern portions of Minnesota and South Dakota. Mr. Ernest Thompson Seton has kindly furnished the Biological Survey with the two most northerly records, and has sent a specimen from Sioux Falls, South Dakota, where these skunks are said to be common. He states that two were killed by a trapper in March, 1904, on the Mississippi River 40 miles southeast of Minneapolis. The animal was previously unknown to the trappers in that region, so that this is doubtless an instance of recent extension of range.

Specimens examined.—Total number, 44, from the following localities:

Kansas: Onaga, 8; Trego County, 8; Fort Leavenworth, 1; Manhattan, 2; Burlington, 1; Long Island, 3; Cairo, 3; Fort Riley, 1 (skull).
Iowa: Gladbrook, 1; Marshalltown, 2.
South Dakota: Sioux Falls, 1.
Nebraska: London, 1; Beemer, 1.
Missouri: Courtney, 1.
Oklahoma: Alva, 1; Mount Scott, Wichita Mountains, 4.
Texas: Canadian, 1; Cooke County, 1 (skull); Brazos, 3.

SPILOGALE INDIANOLA Merriam. GULF SPOTTED SKUNK.

Spilogale indianola Merriam, N. Am. Fauna No. 4, p. 10, 1890.

Type locality.—Indianola, Texas.

Geographic distribution.—Coast region of Texas and Louisiana; south to Victoria, Tamaulipas.

General characters.—Resembling *S. interrupta*, but with a pronounced white tip to the tail; skull relatively narrow.

Color.—Similar to *interrupta;* dorsal stripes frequently interrupted, the median pair usually narrower than outer pair; *tail with a white patch at tip* occupying about one-fourth of the upper surface.

Cranial characters.—Skull similar to that of *putorius*, but much smaller and relatively narrower across mastoids; cranium highly arched, as in the eastern species, but fronto-parietal region only very slightly elevated above plane of skull; zygomata long (in male skulls) and nearly parallel to axis of skull. Compared with *interrupta:* Skull of about the same length, but relatively narrower; inflation of mastoid capsules greater. Teeth as in *putorius* and *interrupta*.

Measurements.—Seven adult males from the coast region of Texas (Virginia Point to Corpus Christi): Total length, 440–520; tail vertebræ, 165–204; hind foot, 46–50; average, 472; 183; 48. Average of two females from San Antonio, Texas: 406; 162; 39.5. Skull: (See table, p. 36.)

General remarks.—When this species was described, only two skulls (both of females) were available. The skin characters and cranial characters of the males were unknown. Since that time a good series of both skins and skulls has been secured by the collectors of the Biological Survey, which shows that the species is even more strongly marked than the describer supposed. Externally it closely resembles the whiter specimens of *interrupta*, but may be distinguished by the white-tipped tail. Skulls of males and females show greater differences than is usual in this genus, the former being longer, broader in the mastoid region, and flatter in the fronto-parietal region than skulls of females. Comparison with *ambarvalis* is hardly necessary, the reduction of the white markings and long skull with heavy dentition being sufficiently distinctive.

The relationships of this species are wholly with the forms occupying the regions to the northward, and not with the Mexican or western species.

Specimens examined.—Total number, 20, from the following localities:

Texas: Indianola, 2 (skulls); Virginia Point, 2; Elliott's, Matagorda County, 1; Edna, 1; Rockport, 2; Beeville, 1; Corpus Christi, 4; San Antonio, 5.
Louisiana: Iowa, Calcasieu Parish, 1.
Tamaulipas: Victoria, 1 (skull).

SPILOGALE LEUCOPARIA Merriam. RIO GRANDE SPOTTED SKUNK.

Spilogale leucoparia Merriam, N. Am. Fauna, No. 4, p. 11, 1890.

Type locality.—Mason, Texas.

Geographic distribution.—Arid region of western Texas and southern New Mexico; south over the eastern side of the Mexican table-land to Hidalgo; west to central Arizona.

General characters.—White markings extensive; skull with greatly inflated mastoid capsules.

Color.—White markings very broad, especially the lateral stripes and outer pair of dorsal stripes; frontal spot and patch in front of ear large; no white on legs; tail with terminal fourth above and terminal two-thirds below, white.

Cranial characters.—Skull of about the same length as that of *indianola, but brain case broader and flatter; mastoid capsules greatly inflated;* audital bullæ larger; upper molars similar in shape, but decidedly smaller; lower carnassial slightly smaller.

Measurements.—Average of three adult males from Rio Grande Valley (Eagle Pass, Laredo, Samuels): Total length, 402; tail vertebræ, 145; hind foot, 47.7. Average of three adult females from Texas (Eagle Pass, Langtry, Waring): 377; 147; 41. Skull: (See table, p. 36.)

General remarks.—This species, as would be expected, is more closely related to the forms occupying the arid regions of the West than to those in the Mississippi Valley. Its peculiar skull serves readily to distinguish it from the other members of the genus. Two specimens from Sierra Encarnacion, Coahuila, have slightly larger skulls than the type, with the postorbital processes well developed; the white body stripes are also slightly narrower than in the typical form. A specimen from Tulancingo, Hidalgo (provisionally referred to this species), likewise has less white on the body. A specimen from Fort Clark, Texas, is apparently intermediate between *leucoparia* and *ambigua*. It resembles the former in having large bullæ and inflated mastoids, but the cranium is relatively narrow and high, as in *ambigua*.

A specimen from Flagstaff, Arizona (No. 1900, Am. Mus. Nat. Hist.), is larger than typical specimens, and the rostrum is very broad and flat: in other respects it agrees perfectly with *leucoparia*, as does also another specimen (No. 1890, Am. Mus. Nat. Hist.), from Fossil Creek, Arizona.

Specimens examined.—Total number, 22, from the following localities:

Texas: Mason, 3; Comstock, 1; Waring 1; D'Hanis, Medina County, 1; Eagle Pass, 2; Turtle Creek, Kerr County, 2; Laredo, 1; Samuels, 1.
New Mexico: Tularosa, 1.
Arizona: Flagstaff, 1; Fossil Creek, Verde River, 1.
Nuevo Leon: Monterey, 2 (skulls).
Coahuila: Sierra Encarnacion, 3; Saltillo, 1.
Hidalgo: Tulancingo, 1.

SPILOGALE TENUIS Howell. Rocky Mountain Spotted Skunk.

Spilogale tenuis Howell, Proc. Biol. Soc. Wash., XV, p. 241, 1902.

Type locality.—Arkins, Colorado.

Geographic distribution.—Eastern slopes of the Rocky Mountains in Colorado and northern New Mexico; limits of range unknown.

General characters.—Size large; white markings prominent; skull long and narrow.

Color.—Similar in markings to *S. leucoparia*, but lateral stripe narrower: frontal patch long and narrow (in type specimen, 32 by 16 mm.); terminal third of tail white.

Cranial characters.—Skull similar in general shape to that of *indianola*, but *longer and relatively narrower; brain case broad and very flat;* fronto-parietal region not elevated above plane of skull; *rostrum and postorbital region narrow*, but without pronounced constriction, the narrowness including also the anterior portion of brain case; zygomata not widely expanded, and nearly parallel to axis of skull; palate long, reaching beyond the plane of last molars; audital bullæ and mastoid capsules moderately inflated; teeth rather small; upper molars with projection of inner lobe behind middle of tooth. Compared with *leucoparia* the skull of *tenuis* is much longer and relatively narrower; brain case flatter and mastoids much less inflated.

Measurements.—Type (adult ♂): Total length, 450; tail vertebræ, 165; hind foot, 51; young female from near Folsom, New Mexico: 400; 160; 47. Skull: (See table, p. 36.)

General remarks.—This species is most nearly related to *S. leucoparia*, which it resembles in markings but from which it differs widely in skull characters. The skull of a young female from the type locality is shorter, and broader interorbitally than that of the type, but is narrower across the mastoids—a condition due in part to immaturity. An adult female skull from Estes Park agrees with the type in narrowness, but is much smaller. An adult male skull from near Folsom, New Mexico, is broader than the type, both zygomatically and in the rostral and postorbital regions, but is slightly narrower across the mastoids.

No specimens are available from farther north than Arkins, Colorado, but it is not unlikely that the form occupying the Black Hills and eastern Wyoming (see *antea*, p. 7) may prove to be referable to this species.

Specimens examined.—Total number, 5, from the following localities:

Colorado: Arkins, 2; Estes Park, 1.
New Mexico: Oak Canyon, 5 miles north of Folsom, 2.

SPILOGALE GRACILIS Merriam. CANYON SPOTTED SKUNK.

Spilogale gracilis Merriam, N. Am. Fauna No. 3, p. 83, 1890.

Type locality.—Grand Canyon of the Colorado (north of San Francisco Mountain), Arizona.

Geographic distribution.—Northern Arizona and desert ranges of southeastern California; south in the Sierra Madre to Jalisco and Michoacan.

General characters.—Similar in size and color to *S. leucoparia;* skull with mastoid capsules less inflated.

Color.—Markings essentially as in *S. leucoparia;* white in tail proportionally less.

Cranial characters.—Skull about the size of that of *indianola*, but relatively broader; *brain case flattened;* fronto-parietal region depressed to general level of upper surface of skull; postorbital constriction pronounced; mastoid capsules moderately inflated; postorbital processes slightly developed; teeth of similar shape, but smaller. Compared with *leucoparia:* Postorbital constriction usually greater; audital bullæ and *mastoid capsules much less inflated;* teeth similar.

Measurements.—Five adult males from Grand Canyon, Arizona, and Panamint Mountains, California: Total length, 334–400; tail vertebræ, 130–160; hind foot, 41–46; average: 381; 143; 44.3. Adult female from Inyo Mountains, California: 330; 120; 37. Skull: (See table, p. 36.)

General remarks.—Arizona specimens of this genus have proved extremely puzzling, and the material in hand is insufficient to determine with certainty the relationships and ranges of the several forms. [illegible] species or subspecies apparently occur in the Territory—*gracilis*, [illegible], [illegible], and *leucoparia*. *S. gracilis* occupies the northern and central portions of the Territory (intergrading at the north with the Great Basin form, *saxatilis*) and apparently extends far south along the Sierra Madre into Mexico. *S. ambigua* belongs to the high [illegible] type represented throughout Mexico, the range of which extends northward to central Arizona, where it overlaps that of *gracilis*. *S.* [illegible] occurs with the preceding forms over most of central and southern Arizona. *S. leucoparia* enters the region from New Mexico and appears to be nearly typical at Flagstaff, in central Arizona. These four forms either intergrade or hybridize in this region, with the result that many individuals can not satisfactorily be referred to one or the other. There are no appreciable color differences, and in identifying specimens dependence must be placed alone on skull characters.

S. gracilis is a small, slender species with a moderately flattened [illegible]. It seems to maintain its characters with little change over an extensive area. A specimen from Patzcuaro, Michoacan, a place widely separated from the type region, is remarkably close to the [illegible] characters; its skull is a little smaller and has a slightly [illegible] rostrum. A specimen from near Fort Verde, Arizona (No. [illegible], Am. Mus. Nat. Hist.), shows some indication of intergradation with *ambigua*, its skull being somewhat higher than that of [illegible]. A very old skull from Prescott, Arizona (No. [illegible], [illegible] Mus. Nat. Hist.), has a more swollen braincase and larger [illegible] than is usual in skulls of [illegible]. Three [illegible] Panamint Mountains, California, have skulls even [illegible] than that of the type.

Specimens examined.—Total number [illegible], from the following localities:

Arizona: Grand Canyon, north of San [illegible] Mountain [illegible]; [illegible] Verde; 30 miles south of Fort Verde [illegible].
California: Panamint Mountains [illegible].
Chihuahua: [illegible].
Jalisco: [illegible].
Michoacan: [illegible].

[illegible] SPILOGALE GRACILIS SAXATILIS [illegible]

[illegible] Merriam, N. A. Fauna [illegible]

Type locality.—Provo, Utah.

Geographic distribution.—Utah, western Colorado, northern Nevada, southern Idaho, eastern Oregon, and northeastern California.

General characters.—Similar to *S. gracilis*, but [illegible] larger and with lateral stripe usually absent.

Color.—Essentially as in *gracilis*, but lateral stripe usually absent or very much reduced. In the type and three topotypes it is faintly indicated by a narrow band. A little less white in tail.

Cranial characters.—Skull similar to that of *gracilis*, but slightly larger; brain case broader; postorbital processes more strongly developed; ridge on mastoids pronounced.

Measurements.—Two males from type locality: Total length, 422-450; tail vertebræ, 163-176; hind foot, 45-49. Average of two females from type locality: 403; 152; 41.5. Adult male from Harney, Oregon: 455; 155; 50. Average of three adult females from Oregon: 360; 129; 40. Skull: (See table, p 36.)

General remarks.—This form is closely related to *S. gracilis*, from which it differs chiefly in larger size and the reduction of the white side stripes. Specimens from eastern Oregon (Harney, Shirk, and Plush) have the white markings somewhat reduced in extent, and the lateral stripe is entirely absent in several of them. The dorsal stripes, especially the median pair, are narrower than in the typical form.

The deep emargination of the nares, shown in the skull of the type proves to be an inconstant character, for the skulls of the three topotypes examined do not differ from skulls of *gracilis* in depth of emargination. In a skull of *saxatilis* from Harney, Oregon, the emargination is about half as deep as in the type skull. In the postorbital constriction of the skull *saxatilis* does not differ appreciably from *gracilis*.

A specimen from St. George, Utah, though agreeing with *gracilis* in markings, is nearer to *saxatilis* in skull characters. Its skull is the longest one in either series and has the ridge on the mastoids pronounced, as in *saxatilis;* the postorbital processes, however, are very small.

No specimens of *Spilogale* have been examined from Idaho, but Doctor Merriam reports this form common in the canyons of Snake River, and records a skin taken by himself at Marsh Valley [in Bannock County, southeast of Pocatello].[a]

Specimens examined.—Total number, 16, from the following localities:

Utah: Provo, 4; St. George, 1.
Colorado: Grand Junction, 1; Coventry, 1.
Nevada: Cottonwood Range, 1.
Oregon: Plush, Lake County, 4; Shirk, Harney County, 1; Harney, 2.
California: Susanville, 1.

SPILOGALE AMBIGUA Mearns. CHIHUAHUA SPOTTED SKUNK.

Spilogale ambigua Mearns, Proc. U. S. Nat. Mus., XX, p. 460, 1897.

Type locality.—Eagle Mountain, Chihuahua (about 4 miles south of Monument No. 15, Mexican boundary line).

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[a] N. Am. Fauna No. 5, p. 84, 1891.

Geographic distribution. From central Arizona south over the western edge of the Mexican table-land to Jalisco.

General characters. Closely similar in markings to *S. gracilis;* [illegible] with highly arched cranium, as in *ambarvalis* and other eastern [illegible]

Color. Essentially as in *gracilis;* lateral stripes very broad; a [illegible] band on the thighs.

Cranial characters. Skull very similar to that of *S. ambarvalis;* [illegible] *arched;* fronto-parietal region elevated; interorbital [illegible] pronounced; postorbital processes well developed; zygomata [illegible] expanded, mastoid capsules and audital bullæ not greatly [illegible] sagittal crest slightly developed; palate short, ending on a [illegible] posterior border of molars; upper molars of exactly similar [illegible] and size to those of [illegible]

Compared with *gracilis:* Skull shorter and relatively broader; [illegible] *higher; rostrum more depressed;* zygomata more abruptly [illegible], postorbital processes larger.

Measurements. Type (adult ♂): Total length, 411; tail vertebræ, [illegible] hind foot, 45. Average of two adult males from Chihuahua and [illegible] 377; 121; 45.5. Skull. (See table, p. 36.)

Remarks. As stated by Doctor Mearns, this species [illegible] relationship with the forms inhabiting central Mexico than with [illegible] the United States species. It [illegible] in fact only the most [illegible] member of a distinct group of species occupying the Mexican [illegible] from the United States boundary to Guatemala. [illegible] all the more surprising its remarkably close resemblance [illegible] characters to *S.* [illegible] the range of [illegible] that of [illegible] skull of [illegible] being [illegible] differences between [illegible] has a white [illegible] on the thighs [illegible] white patches at the base of the [illegible] longer.

The range of [illegible] M [illegible]

[illegible]

Chihuahua [illegible]

Jalisco: [illegible]

Arizona. [illegible]

SPILOGALE ANGUSTIFRONS Howell. TABLE-LAND SPOTTED SKUNK.

Spilogale angustifrons Howell, Proc. Biol. Soc. Wash., XV, p. 242, 1902.

Type locality.—Tlalpam, Federal District, Mexico.

Geographic distribution.—Southern portion of the Mexican tableland, from Guanajuato to the isthmus of Tehuantepec.

General characters.—Size small; coloration as in *S. ambigua*, but usually without white bands on thighs. Skull slender, and without prominent ridges.

Color.—Similar to that of *ambigua*, but lateral stripes averaging broader; white bands on thighs usually absent.

Cranial characters.—Skull similar to that of *ambigua*, but smaller and narrower; cranium highly arched; *rostrum narrow;* sagittal crest practically obsolete; postorbital constriction slight; postorbital processes small; audital bullæ relatively large; mastoid capsules moderately inflated; molars smaller than in *ambigua*, the upper and lower carnassials decidedly so.

Measurements.—Type (adult ♂): Total length, 345; tail vertebræ, 130; hind foot, 40. Average of three adult males from the type locality: 333; 121; 42. Adult female from type locality: 325; 105; 36. Skull: (See table, p. 36.)

General remarks.—This species belongs to the group of narrow-skulled species inhabiting the eastern United States and northern Mexico. Its nearest relative is *S. ambigua*, with which it may intergrade, though no intermediate specimens are known. Its slender skull, without ridges and with narrow rostrum, distinguishes it from any of its relatives. A specimen from Yautepec, Morelos, differs from the typical form in having thigh bands; its skull, however, is entirely typical.

Specimens examined.—Total number, 8, from the following localities in Mexico:

Mexico: Tlalpam, 5.
Morelos: Yautepec, 1.
Guanajuato: Santa Rosa, 2.

SPILOGALE ANGUSTIFRONS TROPICALIS Howell. TROPICAL SPOTTED SKUNK.

Spilogale angustifrons tropicalis Howell, Proc. Biol. Soc. Wash., XV, p. 242, 1902.

Type locality.—San Mateo del Mar, Oaxaca, Mexico.

Geographic distribution.—Coast region of southern Oaxaca.

General characters.—Similar to *S. angustifrons*, but larger; skull with smaller teeth and larger mastoid capsules.

Color.—Averaging with more white than *angustifrons;* lateral stripes large, and *reaching down on to foreleqs;* white patches at base of tail large; white bands on thighs usually present, but variable in size.

Cranial characters.—Skull larger and more angular than that of *stifrons; rostrum broader;* mastoid capsules more inflated; audital [illegible] flatter; upper molars and last lower molars relatively smaller; [illegible] *olars not evenly rounded on inner side*, but with a narrow projecting lobe at the postero-internal corner; palate long, usually reaching beyond the posterior border of molars. Compared with *ambigua*, mastoid capsules are more inflated, zygomata less widely expanded, teeth much smaller. Skulls of females are but little smaller than those of males, and lack the sagittal crest.

M[illegible]ts. Five adult males from type locality: Total length, [illegible]–387; tail vertebræ, 114–145; hind foot, 40–46; average, 363; 134; [illegible] Average of three adult females from type locality, 339; 125; 38. [illegible] (See table, p. 37.)

[illegible] [illegible]rks. This form apparently is confined to the tropical [illegible]s on the west side of the isthmus of Tehuantepec. Specimens from the city of Tehuantepec, which is only a few miles from the type locality, are not typical, but show intergradation with the highland form *elata* in skull characters.

Although the habitat of *tropicalis* is widely removed from that of [illegible], the two seem to be closely related. No intermediate specimens have been examined, however.

The present form is remarkable for the great amount of variation in the size of the skull. In the type series of eight specimens this amounts in the basilar length to 17 per cent of the average.

Specimens examined. Total number, 1[illegible], from the following localities:

Oaxaca: San Mateo del Mar, [illegible]; Tehuantepec [illegible]; Santo [illegible]

SPILOGALE ANGUSTIFRONS ELATA [illegible]

[illegible]

Type from San Bartolomé, Chiapas, [illegible] Adult [illegible], No. [illegible], U. S. National Museum, Biological Survey Collection. Collected [illegible], by E. A. Goldman. Original No. [illegible]

Geographic distribution. Highlands of Chiapas [illegible] Guatemala (?); limits of range unknown.

General characters. Similar to *S. [illegible] tropicalis*, but with narrower [illegible] and heavier dentition.

Color. Agrees with *tropicalis* in markings, but has a little [illegible] of tail. The type specimen [illegible]

[illegible]

[illegible]

pressed below level of upper [illegible]

See table of measurements [illegible]

[illegible] adult [illegible]

[illegible] comparison is made with [illegible]

[illegible] locality are somewhat smaller.

developed; *mastoids not inflated*, but with a pronounced ridge; upper molars larger than in *tropicalis* and more evenly rounded on inner side; lower carnassial decidedly broader; inter-pterygoid fossa broader.

Measurements.—Type (adult ♂): Total length, 385; tail vertebræ, 123; hind foot, 45. Skull: (See table, p. 37.)

General remarks.—This form is closely related to *S. tropicalis*, from which it differs chiefly in cranial characters. It differs from *angustifrons* in having a much larger skull, but agrees with it in the form of the upper molars.

Specimens examined.—Total number, 3, from the following localities:

Chiapas: San Bartolomé, 1; Pinabete, 1.
Costa Rica (locality not known [a]), 1.

SPILOGALE PYGMÆA Thomas. PYGMY SKUNK.

Spilogale pygmæa Thomas, Proc. Zool. Soc. London for 1897, p. 898, 1898.

Type locality.—Rosario, Sinaloa.

Geographic distribution.—Known only from the type locality and from Acapulco, Guerrero.

General characters.—Size very small; *dorsal stripes not broken into patches on hinder parts;* a transverse band of white across face between the eyes.

Color.[b]—Median pair of dorsal stripes *grayish* (caused by intermixture of black and white hairs), connected anteriorly, each divided at the middle of the back into two narrow stripes, the outer one of which is continued transversely until it joins the lateral stripe, while the inner one extends across the rump to the under surface of the body, where it nearly joins the corresponding stripe on the other side; a narrow transverse band on each thigh, confluent with a small patch at base of tail; lateral stripes broad, and of a distinctly yellowish hue; outer pair of dorsal stripes also yellowish, narrow, except anteriorly, where they spread out into broad patches behind the ears; frontal patch white, *broader than long, and united by a narrow stripe with the outer dorsal stripes;* upper surface of both fore and hind feet white; tail all white, except for the basal half-inch below, and a slight admixture of black above covering the basal two-thirds.

Cranial characters.—Skull very small; cranium narrow and highly arched; fronto-parietal region scarcely elevated above plane of skull; postorbital constriction slight; postorbital processes minute; no trace of a sagittal crest; palate short, not reaching plane of posterior border of molars.

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[a] This specimen was sent to the World's Fair at Chicago by the Costa Rican Commission. Mr. George K. Cherrie, in response to an inquiry concerning it, states that his recollection is that the specimen came from the neighborhood of Alajuela, at about 3,000 feet altitude, on the Pacific side of the Cordillera.

[b] Description drawn from a specimen in the Biological Survey Collection.

Measurements.—Adult male from Acapulco, Guerrero: Total length, 40: tail vertebræ, 72; hind foot, 33. Type (adult ♀): 182; 68; 34.[a] Skull: (See table, p. 37.)

General remarks.—This remarkable species may be easily distinguished from all its relatives by its exceedingly small size and peculiar pattern of coloration. It evidently is not a common species, for up to the present time only two examples have found their way into museum collections—the type in the British Museum, and one specimen in the Biological Survey collection taken by Nelson and Goldman. The latter specimen was caught in a trap set below the surface of the ground in the burrow of a pocket gopher (*Orthogeomys*). It is an adult male and is even smaller than the type[b] (a female), but agrees in every other respect with the description given by Mr. Thomas.

SPILOGALE ARIZONÆ Mearns. ARIZONA SPOTTED SKUNK.

Spilogale phenax? arizonæ Mearns, Bull. Amer. Mus. Nat. Hist., III, p. 256, 1891.

Type locality.—Fort Verde, Arizona.

Geographic distribution.—Central and southern Arizona, southwestern New Mexico, and adjacent parts of Mexico.

General characters.—Similar to *S. gracilis*, but with larger and more angular skull.

Color.—Markings as in *leucoparia* and *gracilis;* lateral stripe very broad; tail with terminal fourth above, and terminal half below, white.

Cranial characters.—Skull larger than that of *gracilis; zygomata widely and abruptly expanded*, arched upward at widest point so as to be decidedly higher than in *gracilis;* brain case broad and flat; *rostrum and inter-temporal region narrow;* postorbital processes much larger; bullæ slightly larger; upper molars relatively small.

Measurements.—Type (adult ♂): Total length, 445; tail vertebræ, 160; hind foot, 50.[c] Average of 3 adult males from Fort Huachuca, Arizona, and San Jose Mountain, Sonora: 422; 151; 45.3. Adult female from Fort Huachuca, Arizona: 380; 148; 40. Skull: (See table, p. 37.)

General remarks.—This species, although represented by only a small number of specimens in the series examined, is apparently a well-marked form. The material available at the present time shows that it is not, as the describer supposed, a subspecies of *phenax*. Compared with the latter species, *arizonæ* is very much smaller, with relatively broader brain case and larger audital bullæ. Although occupying a portion of the range of *gracilis*, no intermediates between these two forms have been discovered. Intergradation with *leucoparia* is more probable, though the material at present available is not sufficient to determine this question with certainty. Two specimens of nearly typical *leucoparia* have been taken within the range of *arizonæ*, but on the other hand a specimen from Pinal County, Arizona (No. 610, Am. Mus. Nat. Hist.), is in some respects intermediate between the two forms.

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[a] *Fide* Thomas. [b] See table of cranial measurements, p. 37. [c] *Fide* Mearns.

Typical *ambigua* also occurs in the range of *arizonæ*, and at least one specimen (No. 1902, Am. Mus. Nat. Hist., from Whipple Barracks) combining the characters of these two species has been examined. By reason of the wide differences between typical specimens of the two species, and in view of the fact that they occur together in the typical forms, it seems preferable to consider the intermediate specimens as the product of hybridization rather than of intergradation.

Specimens examined.—Total number, 8, from the following localities:

Arizona: Fort Verde, 1; Fort Huachuca, 3; Pinal County, 1 (not typical); Whipple Barracks, 1 (not typical).
New Mexico: Rio Mimbres (near head), 1.
Sonora: San Jose Mountain, 1.

SPILOGALE ARIZONÆ MARTIRENSIS Elliot. PENINSULA SPOTTED SKUNK.

Spilogale arizonæ martirensis Elliot, Field Columb. Mus., Zool. Series, III, p. 170, 1903.

Type locality.—Vallecitos, San Pedro Martir Mountains, Lower California, Mexico.

Geographic distribution.—Lower California, from San Pedro Martir Mountains south to Comondú. Range probably not continuous.

General characters.—Similar to *S. arizonæ*, but smaller.

Color.—Not appreciably different from *S. arizonæ*.

Cranial characters.—Skull decidedly smaller than that of *arizonæ*, *with very narrow rostrum;* zygomata narrower and less abruptly expanded; molars smaller.

Measurements.—Type (adult ♂): Total length, 395; tail vertebræ 143; hind foot, 44; five adult males from San Pablo, San Ignacio, and Mulejé: Total length, 365–404; tail vertebræ, 133–155; hind foot, 42–47.5; average: 381; 148; 45.3. Average of two adult females from San Ignacio and Comondú: 375; 142; 40.2. Skull: (See table, p. 37.)

General remarks.—This subspecies was based on specimens collected at an altitude of 9,000 feet in the San Pedro Martir Mountains. The collector, Mr. Edmund Heller, considers the animals to be very scarce in that region. Nelson and Goldman collected at the type locality in 1905, but secured no skunks. Specimens of this form, however, were taken by them much farther south on the Peninsula at an altitude but little above sea level. A specimen from Mulejé agrees very closely with the type, except that the lower carnassial is somewhat smaller. The skulls of two adult males from San Ignacio are slightly broader interorbitally and narrower across the mastoids. Although the range of this form is probably cut off from that of *arizonæ* by the Colorado

parison of the external measurements, and more especially those of the skull. Thus, for example, two specimens from Ventura River show a variation of 33 mm. in length of tail vertebræ, 4.8 mm. in basilar length of skull, and 5.7 mm. in occipito-nasal length. Specimens from Los Angeles and San Diego counties apparently have smaller hind feet than the typical form, but do not differ appreciably in other respects. Specimens from Three Rivers and San Emigdio have skulls averaging longer and narrower inter-temporally than those of the typical form. The skull of an adult male specimen from Alila, Tulare County (in the San Joaquin Valley), differs from typical skulls in being smaller and relatively broader zygomatically, the zygomata spreading abruptly at the posterior end and curving strongly upward. In these characters it resembles the skull of *S. arizonæ*, but it differs widely from that species in other respects.

Specimens examined.—Total number, 95, from the following localities:

California: Baird, Shasta County, 1; Stillwater, Shasta County, 1; Dyerville, 1; Rio Dell, Humboldt County, 5; Auburn, 1; Mount St. Helena, 1; Glen Ellen, 2; Nicasio, 3; Point Reyes, 5; Berkeley, 1; Fairfield, 1; Sausalito, 1; Carbondale, 1; Tracy, 1; Santa Clara, 2; Boulder Creek, 1; Morro, 1; Pozo, 1; San Luis Obispo, 5; Santa Ynez Mission, 2; Ventura River, 2; Santa Paula, 2; Wawona, 1 (skull); Three Rivers, 6; Kaweah, Tulare County, 1; Milo, 3; Kern River Lakes, 2; Alila, 5; Delano, 1; Portersville, 1; San Emigdio, 5; Box Spring, Riverside County, 2; San Bernardino, 4; San Bernardino Peak, 1; Alhambra, 4; Los Angeles, 1; San Jacinto Mountains, 1; Twin Oaks, 1; Santa Ysabel, 3; Witch Creek, 1; Dulzura, 6; La Puerta, San Diego County, 1; San Diego, 2; Valley Center, San Diego County, 1; Santa Cruz Island, 1.

SPILOGALE PHENAX LATIFRONS Merriam. OREGON SPOTTED SKUNK.

Spilogale phenax latifrons Merriam, N. Am. Fauna No. 4, p. 15, 1890.

Type locality.—Roseburg, Oregon.

Geographic distribution.—Coast region of Oregon and northern California.

General characters.—Smaller than *S. phenax;* black markings more prominent; rostrum broader.

Color.—*Black markings prominent;* outer pair of dorsal stripes averaging narrower than in *phenax;* median pair usually very narrow, though sometimes of same width as outer pair; lateral stripe frequently absent or much reduced; white patches and transverse bands on hinder part of body small.

Cranial characters.—Skull shorter and relatively broader than that of *S. phenax; rostrum actually as well as relatively much broader.*

Measurements.—Six adult males from Oregon (Gardiner, Goldbeach, Beaverton, and Marshfield): Total length, 382–435; tail vertebræ, 117–146; hind foot, 45–50; average: 408; 127; 47.7. Eleven adult females from Oregon: Total length, 335–403; tail vertebræ, 105–140; hind foot, 39–46; average: 373; 122; 42.8. Skull: (See table, p. 37.)

[illegible] *marks.* This subspecies, originally described from a single [illegible] specimen, proves to be a well marked form. It has somewhat [illegible] than S. *phenax* and a shorter tail. The broad rostrum [illegible] constant and distinctive character. Intergradation [illegible] apparently takes place in Shasta County, California, but [illegible] a specimen from Point Reyes, California, where [illegible] occurs, is clearly referable to *latifrons*.

[illegible] *examined.* Total number, [illegible], from the following locali[illegible]

Oregon: [illegible], 2; Eugene, 2; [illegible], 2; Beaverton, [illegible] Hermann, Lane County, [illegible] Marsh[illegible] [illegible], 2 skulls; M[illegible]

California: H[illegible]brook, 5; Point Reyes, [illegible]

[illegible] PHENAX OLYMPICA [illegible]

[illegible] Field Columbian Museum, Zo[illegible] Ser., [illegible]

[illegible] Lake Sutherland, Olympic Mountains, Washington.

[illegible] *distribution.* The Olympic Peninsula and shores of [illegible] Sound; north (probably) to Howe Sound, British Columbia.

[illegible] Similar to S. *p. latifrons;* tail slightly shorter; [illegible]

Markings as in S. *p.* [illegible], but white spot on forehead [illegible] longer, and narrower anteriorly.

[illegible] Skull slightly smaller than that of S. [illegible] Compared with S. *p.* [illegible], and brain case relatively narrow and [illegible] nearly square.

[illegible] Type (immature [illegible]): Total length, [illegible] foot, 41 [illegible]. Average of [illegible] males from [illegible] Sound: Mount Vernon, Washington; Sumas, [illegible] M[illegible], British Columbia [illegible]. Average [illegible] same localities [illegible]

[illegible] This form [illegible] differing from S. *p.* [illegible] Compared with *latifrons* the skull of [illegible] rostrum, the narrowing [illegible] The average width of [illegible] across the [illegible] male specimens [illegible]

[illegible] from the eastern [illegible] and Port Moody, B[illegible] than the series from the O[illegible] is more pronounced. [illegible] the series from T[illegible] approach very closely to *latifrons* in skull characters, showing that intergradation takes place in that region.

The upper molar in this subspecies is more nearly square than in *S. phenax*, and the projection of the inner lobe is less pronounced. In some specimens the inner lobe is evenly rounded, almost as in *S. interrupta*, but the point of greatest convexity is farther back than in the latter species.

Specimens examined.—Total number, 90, from the following localities:

Washington: Lake Sutherland, Olympic Mountains, 1; Port Angeles, 2; Lake Cushman, Olympic Mountains, 9 (skulls); Tenino, 8; Steilacoom, 1; Quiniault Lake, 1; Keechelus Lake, 1; Hamilton, 3 (skulls); Mount Vernon, 19 (6 skins with skulls, 13 odd skulls).

British Columbia: Sumas, 3; Hastings, 3; Port Moody, 39 (9 skins with skulls, 30 odd skulls.)

SPILOGALE MICRODON sp. nov. Small-Toothed Spotted Skunk.

Type from Comondú, Lower California. Adult ♂, No. 145887, U. S. National Museum, Biological Survey Collection. Collected November 8, 1905, by Nelson and Goldman. Original No. 18501.

Geographic distribution.—Known only from the type locality.

General characters.—Slightly smaller than *S. phenax*, but tail relatively longer and hind foot shorter; teeth very small.

Color.—Practically identical with *S. phenax;* outer pair of dorsal stripes but little wider than median pair; frontal patch large; tail rather scantily haired, the terminal third white.

Cranial characters.—Skull about the size of small skulls of *S. phenax;* brain case relatively narrow and high; rostrum somewhat broader interorbitally; zygomata less widely and abruptly expanded; *mastoid capsules greatly inflated; teeth very small, particularly the molars and sectorial teeth.* Compared with *S. a. martirensis*, skull much larger and teeth relatively smaller.

Measurements.—Type (adult ♂): Total length, 410; tail vertebræ, 158; hind foot, 45. Skull: (See table, p. 37.)

General remarks.—This species is apparently most nearly related to *S. phenax*, but whether or not their ranges meet can not now be determined with certainty. No specimens of *phenax* are known from farther south than Dulzura, California, and the intervening region is occupied by another species (*S. arizonæ martirensis*). The skull of an adult male topotype differs from that of the type in being somewhat narrower interorbitally and in having a flatter brain case.

Specimens examined.—Two, from the type locality.

SPILOGALE LUCASANA Merriam. Cape St. Lucas Spotted Skunk.

Spilogale lucasana Merriam, N. Am. Fauna, No. 4, p. 11, 1890.

Type locality.—Cape St. Lucas, Lower California, Mexico.

Geographic distribution.—Cape region of Lower California.

General characters.—Size very large; resembling *S. phenax* in markings, but median pair of dorsal stripes broader; skull broad and flat.

Color.—Markings similar to those of *S. phenax*, but *median pair of dorsal stripes broader (nearly equaling outer pair in breadth); lateral stripes continuous with median dorsal stripes;* throat with two narrow white streaks or patches on each side of the median line. Tail nearly all black above, the white confined to a small patch at tip and outer edges of the terminal half; below, the white occupies more than half of the terminal portion.

Cranial characters.—Skull much larger than that of any other species; *brain case flat and very broad;* zygomata nearly parallel to axis of skull; postorbital constriction slight; occipital and sagittal crests highly developed; *mastoids not inflated*, but with pronounced ridge continuous with occipital crest; audital bullæ broad and flattened; paroccipital processes well developed, as in *Mephitis;* lower jaw strongly convex below, and with a suggestion of the 'step' found in *Mephitis;* molars as in *S. phenax*. Skull of female of about the size of female skulls of *phenax*, but molars larger.

Measurements.—Average of 3 adult males from vicinity of type locality: Total length, 531; tail vertebræ, 198; hind foot, 56. Average of 2 adult females from type locality: 434; 166; 46.5. Skull: (See table, p. 37.)

General remarks.—This species is so much larger than any of its congeners that detailed comparison is unnecessary. Its large size is especially remarkable, since in this genus the southern species are generally smaller than the northern ones. In this case, however, *S. lucasana* is much larger than either its nearest neighbors on the north (*S. arizonæ martirensis* and *S. microdon*), or the forms occupying the mainland of Mexico. Females, however, are much smaller than males, and but little larger than females of *S. phenax*.

In some of its characters, notably the development of the paroccipital processes and the 'step' in the lower jaw, this species shows an approach to the genus *Mephitis*. In some specimens the paroccipital processes are as strongly developed as is ordinarily the case in *Mephitis;* in others these processes are much reduced. Externally this species is characterized by broad white stripes, and there is little variation in the extent of the markings; a white thigh band is present in most of the specimens examined. A specimen from Santa Anita shows an unusual amount of white on the underparts, the large transverse stripe on the hips curving forward on the ventral surface and connecting with the lateral stripe near the middle of the belly.

So far as known, the range of this species is confined to the immediate vicinity of Cape St. Lucas.

Specimens examined.—Total number, 9, from the following localities:

Lower California: Cape St. Lucas, 7; Santa Anita, 2.

Average Cranial Measurements of Spilogale.

Species.	Localities.	Sex.	Basilar length.[a]	Occipito-nasal length.	Greatest zygomatic breadth.	Greatest mastoid breadth.	Least interorbital breadth.	Palatilar length.[a]	Post-palatal length.	Foramen magnum to plane of last molars.	Height of cranium.[b]	Number of specimens averaged.	Remarks.
Spilogale ambarvalis	Micco, Florida	♂	45.6	47	32.1	27.8	14.8	17.7	28	27.8	17	7	
	Micco and Fort Kissimmee, Florida	♀	42.3	44	29.9	26.9	13.8	17	25.3	26	16	2	
S. putorius	Roan Mountain, North Carolina	♂	51.6	53.9	35.6	32.3	16.5	20.4	31.2	31.7	17.7	5	
	Greensboro, Alabama	♂	52.9	53.7	36	32.1	15.8	21.2	31.7	32.4	18	4	
	Greensboro, Alabama, and Roan Mountain, North Carolina	♀	48.3	50.2	33.6	29.4	15.2	19.3	28.9	29.2	17.1	5	
S. interrupta	Kansas	♂	50.9	51.4	35.1	31.2	14.9	20.4	30.6	31.2	17.6	6	
	Do	♀	48.1	48.2	32.5	28.9	14.6	19.3	28.7	29.2	16.9	8	
S. indianola	Texas (coast region)	♂	50.1	49.5	34.4	29.7	14.8	19.9	30.2	30.3	17.2	5	
	Virginia Point, Texas, and Calcasieu Parish, Louisiana	♀	45.9	45.8	31.5	27.6	14.5	18.8	27.1	27.3	16.2	2	
S. leucoparia	Mason and D'Hanis, Texas	♂	46.5	49.1	33.8	31.1	14.8	18.9	27	28.8	16.4	4	
	Fossil Creek and Flagstaff, Arizona	♂	48.7	51.2	34.7	32.5	15	20.2	28.5	29.5	15.7	2	
	Waring and Eagle Pass, Texas	♀	43.5	44.9	31.9	29.6	14.5	17.5	26	26.3	15.2	2	
S. tenuis	Arkins, Colorado	♂	52	52.3	34.7	32.5	14.3	20.5	31.5	32	15.5	1	Type.
	Folsom, New Mexico	♂	51.4	52.1	37.3	31.6	15.7	21	30.4	31.2	16	1	
	Arkins and Estes Park, Colorado	♀	45.2	46.2	32.5	28.2	14.3	18.5	26.7	27.3	15.7	2	
S. gracilis	Grand Canyon, Arizona, and Panamint Mountains, California	♂	47	49.4	32.8	28.8	14.2	19.1	27.9	28.4	15.2	3	
	Michoacan and Jalisco, Mexico	♂	45.8	47.9	32.3	29	14.2	18.7	27.2	27.8	15	3	
	Inyo Mountains, California	♀	42	45	29.6	25.3	12.1	16.3	25.7	25.6	13.8	1	
S. g. saxatilis	Provo, Utah, and Harney, Oregon	♂	48.4	49	35.4	30.7	14.6	20.2	27.9	29.6	16	2	
	Do	♀	42.7	43.8	30.8	27.1	13	17.5	25.2	25.6	14.5	2	
S. ambigua	Eagle Mountain, Chihuahua, and Barranca Ibarra, Jalisco	♂	45.5	48.1	34.8	29.7	15.1	18.5	27	27	16.6	2	
	Fossil Creek and Huachuca Mountains, Arizona	♂	45.7	48.9	35	29.5	14	19.2	26.5	27.5	15.8	2	
S. angustifrons	Tlalpam, Federal District, Mexico	♂	42.7	45.4	30.3	26.9	13	17.7	25	25.4	16.2	3	
	Do	♀	40.8	43.7	29.5	25	12.8	16.4	24.4	24.5	15.8	1	

[illegible]*frons; rostrum broader;* mastoid capsules more inflated; audital [illegible] flatter; upper molars and last lower molars relatively smaller; [illegible] *not evenly rounded on inner side*, but with a narrow projecting lobe at the postero-internal corner; palate long, usually reaching beyond the posterior border of molars. Compared with *ambigua*, mastoid capsules are more inflated, zygomata less widely expanded, teeth much smaller. Skulls of females are but little smaller than [illegible] of males, and lack the sagittal crest.

M[illegible]. Five adult males from type locality: Total length, [illegible]-387; tail vertebræ, 114-145; hind foot, 40-46; average, 363; 134; [illegible]. Average of three adult females from type locality, 339; 125; 38. [illegible] See table, p. 37.)

[illegible] This form apparently is confined to the tropical [illegible] on the west side of the isthmus of Tehuantepec. Specimens [illegible] the city of Tehuantepec, which is only a few miles from the type [illegible], are not typical, but show intergradation with the highland [illegible] (*elata*) in skull characters.

Although the habitat of *tropicalis* is widely removed from that of [illegible], the two seem to be closely related. No intermediate specimens have been examined, however.

The present form is remarkable for the great amount of variation in [illegible] size of the skull. In the type series of eight specimens the [illegible] in the basilar length to 17 per cent of the average.

Specimens examined. Total number, 12, from the following localities:

Oaxaca: San Mateo del Mar, [illegible] Te[illegible]

SPILOGALE ANGUSTIFRONS ELATA [illegible]

[illegible] from San Bartolomé, Chiapas [illegible] No. [illegible] National Museum, Biological Survey [illegible] Collected [illegible] by E. A. Goldman. Original No. [illegible]

[illegible] Highlands of Chiapas and Central [illegible] Guatemala (?); limits of range unknown.

[illegible] *characters.* Similar to [illegible] but with narrower [illegible] and heavier dentition.

[illegible] Agrees with [illegible] in [illegible] but has a little less white [illegible] of tail. The type specimen [illegible] white patch [illegible] scarcely [illegible] with the [illegible] dark.

[illegible] Similar to [illegible] rostrum [illegible] and [illegible] pressed below level of upper surface; postorbital processes well

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[illegible] where the average [illegible] given.

[illegible] with the type [illegible] are somewhat smaller.

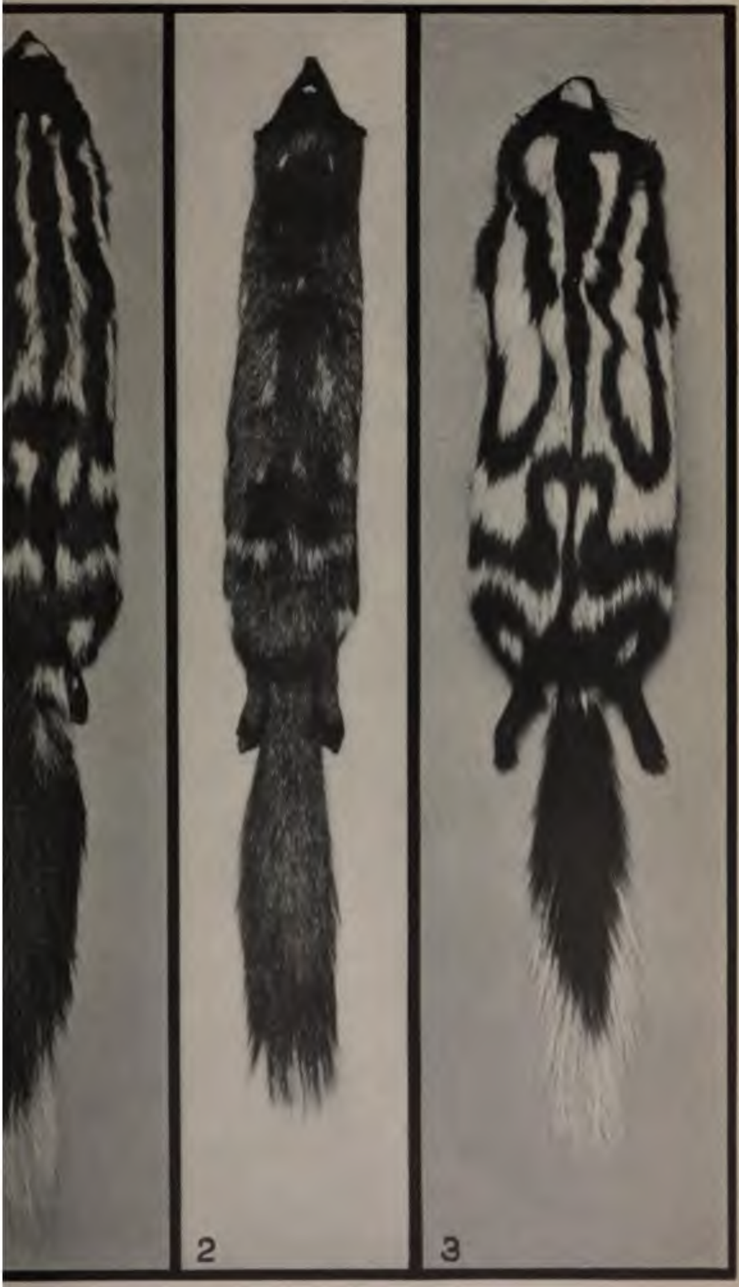
PLATE II.

(Greatly reduced, and relative sizes not accurately shown, owing to differences in preparation of skins.)

FIG. 1. *Spilogale putorius* (Linn.). Roan Mountain, North Carolina (No. 66304, U.S. Nat. Mus.).

2. *Spilogale interrupta* (Rafin.). Onaga, Kansas (No. 25270, U. S. Nat. Mus.).

3. *Spilogale leucoparia* Merr. Type; Mason, Texas (No. 1701, Merriam Collection).



SKINS OF SPILOGALE.

1, Spilogale putorius; 2, Spilogale interrupta; 3, Spilogale leucoparia.

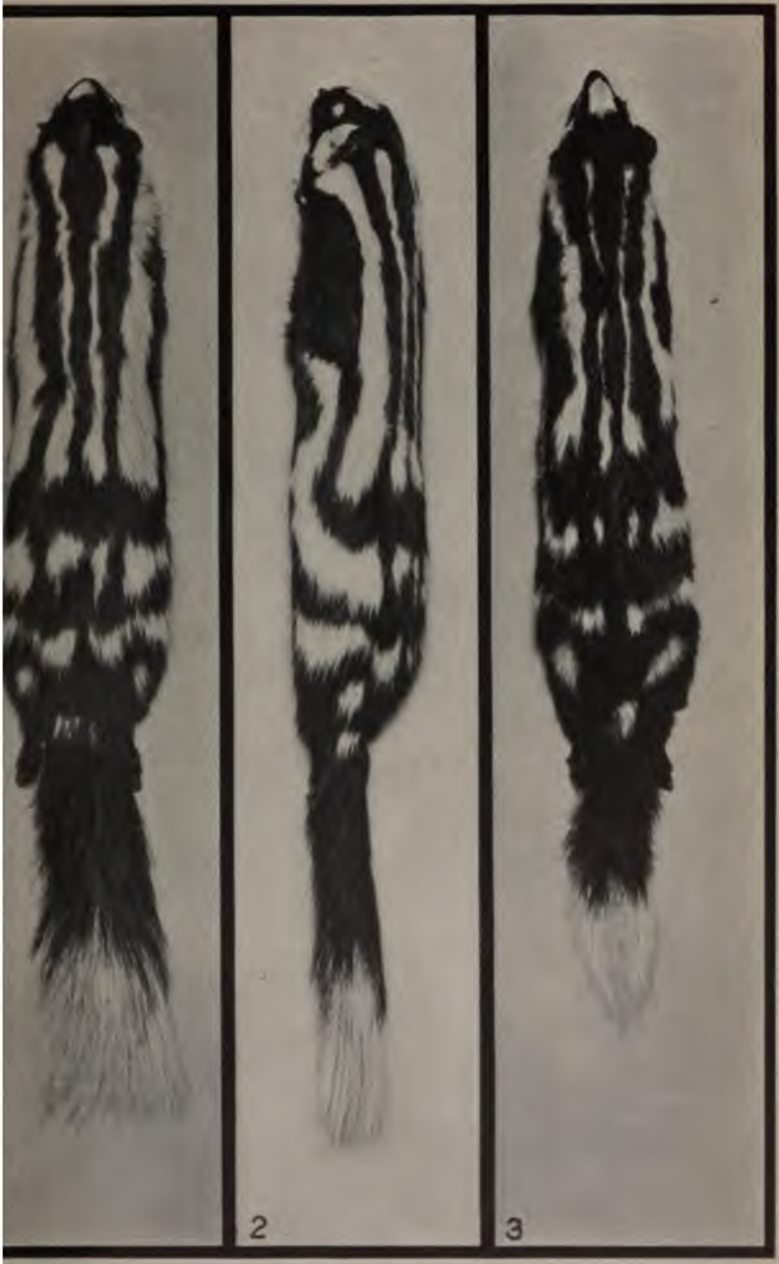
PLATE III.

(Greatly reduced, and relative sizes not accurately shown, owing to differences in preparation of skins.)

FIG. 1. *Spilogale phenax* Merr. San Emigdio, California (No. 31249, U. S. Nat. Mus.).

2. *Spilogale phenax* Merr. Side view of same specimen shown in fig. 1.

3. *Spilogale phenax olympica* Elliot. Quiniault Lake, Washington (No. 89551 U. S. Nat. Mus.).



SKINS OF SPILOGALE.

1, 2, Spilogale phenax; 3, Spilogale phenax olympica.

PLATE IV.

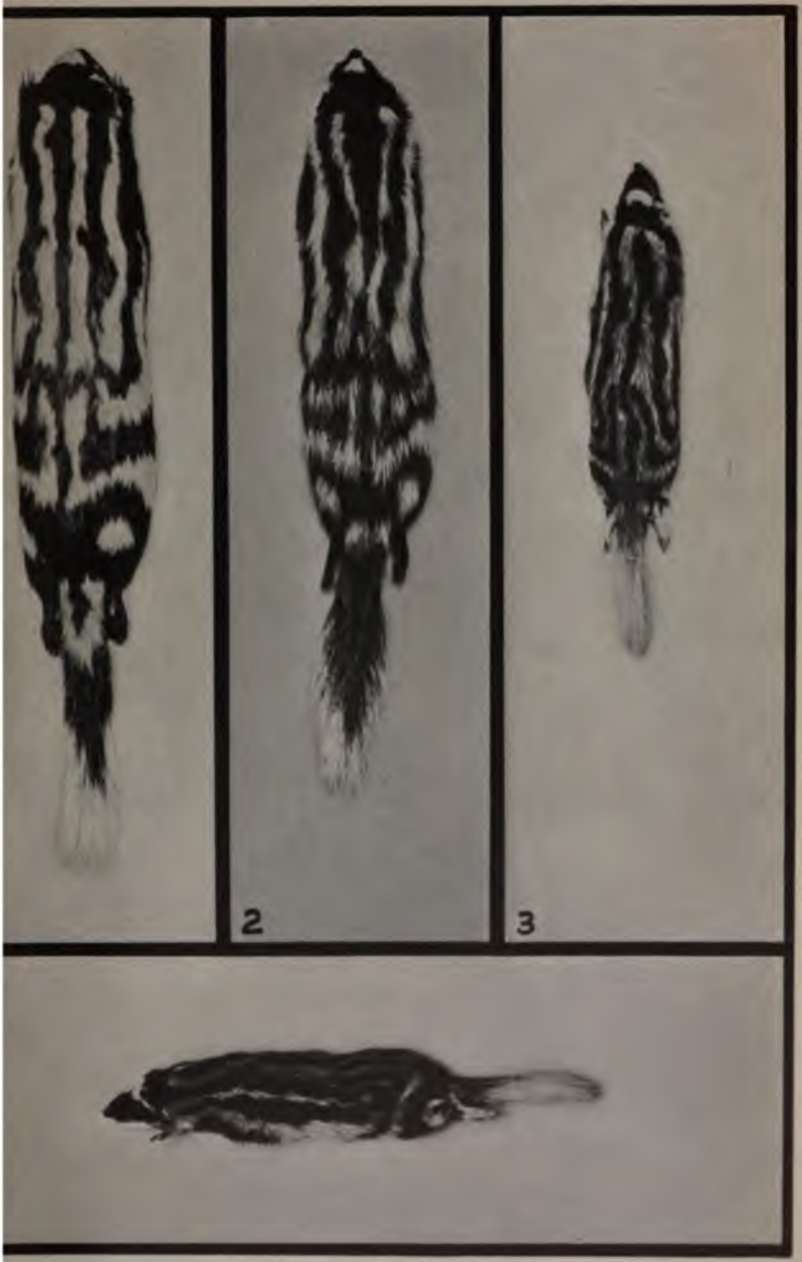
(Greatly reduced, and relative sizes not accurately shown, owing to differences in preparation of skins.)

FIG. 1. *Spilogale ambarvalis* Bangs. Micco, Florida (No. 101988, U. S. Nat. Mus.).

2. *Spilogale angustifrons* Howell. Tlalpam, Federal District, Mexico (No. 50823, U. S. Nat. Mus.).

3. *Spilogale pygmæa* Thomas. Acapulco, Guerrero, Mexico (No. 70581, U. S. Nat. Mus.).

4. *Spilogale pygmæa* Thomas. Side view of same specimen shown in fig. 3.



SKINS OF SPILOGALE.

1, Spilogale ambarvalis; 2, Spilogale angustifrons; 3, 4, Spilogale pygmæa.

developed; *mastoids not inflated*, but with a pronounced ridge; upper molars larger than in *tropicalis* and more evenly rounded on inner side; lower carnassial decidedly broader; inter-pterygoid fossa broader.

Measurements.—Type (adult ♂): Total length, 385; tail vertebræ, 123; hind foot, 45. Skull: (See table, p. 37.)

General remarks.—This form is closely related to *S. tropicalis*, from which it differs chiefly in cranial characters. It differs from *angustifrons* in having a much larger skull, but agrees with it in the form of the upper molars.

Specimens examined.—Total number, 3, from the following localities:

Chiapas: San Bartolomé, 1; Pinabete, 1.
Costa Rica (locality not known [a]), 1.

SPILOGALE PYGMÆA Thomas. PYGMY SKUNK.

Spilogale pygmæa Thomas, Proc. Zool. Soc. London for 1897, p. 898, 1898.

Type locality.—Rosario, Sinaloa.

Geographic distribution.—Known only from the type locality and from Acapulco, Guerrero.

General characters.—Size very small; *dorsal stripes not broken into patches on hinder parts;* a transverse band of white across face between the eyes.

Color.[b]—Median pair of dorsal stripes *grayish* (caused by intermixture of black and white hairs), connected anteriorly, each divided at the middle of the back into two narrow stripes, the outer one of which is continued transversely until it joins the lateral stripe, while the inner one extends across the rump to the under surface of the body, where it nearly joins the corresponding stripe on the other side; a narrow transverse band on each thigh, confluent with a small patch at base of tail; lateral stripes broad, and of a distinctly yellowish hue; outer pair of dorsal stripes also yellowish, narrow, except anteriorly, where they spread out into broad patches behind the ears; frontal patch white, *broader than long, and united by a narrow stripe with the outer dorsal stripes;* upper surface of both fore and hind feet white; tail all white, except for the basal half-inch below, and a slight admixture of black above covering the basal two-thirds.

Cranial characters.—Skull very small; cranium narrow and highly arched; fronto-parietal region scarcely elevated above plane of skull; postorbital constriction slight; postorbital processes minute; no trace of a sagittal crest; palate short, not reaching plane of posterior border of molars.

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[a] This specimen was sent to the World's Fair at Chicago by the Costa Rican Commission. Mr. George K. Cherrie, in response to an inquiry concerning it, states that his recollection is that the specimen came from the neighborhood of Alajuela, at about 3,000 feet altitude, on the Pacific side of the Cordillera.

[b] Description drawn from a specimen in the Biological Survey Collection.

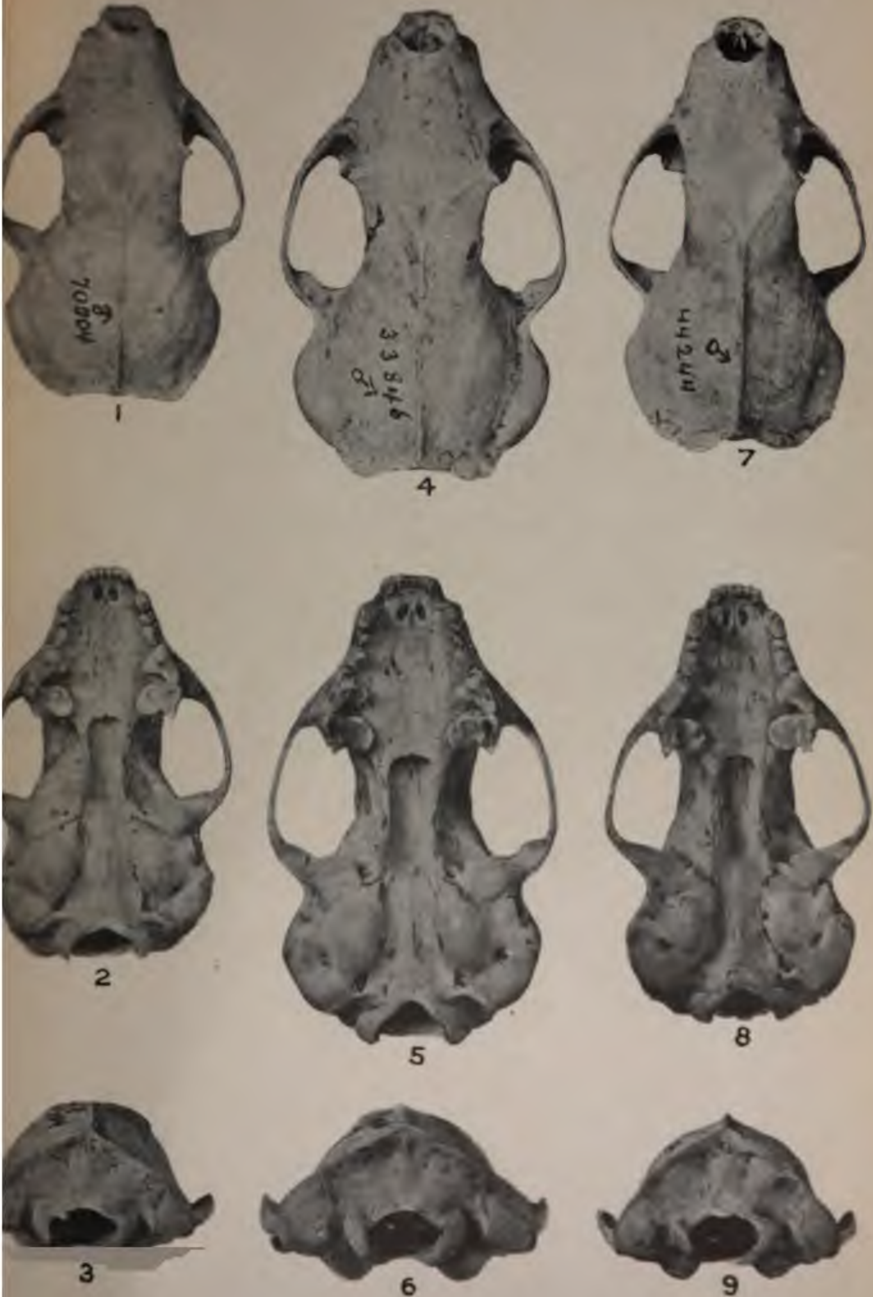
PLATE V.

(Natural size.)

FIGS. 1, 2, 3. *Spilogale ambarvalis* Bangs. ♂, Micco, Florida (No. 70304, U. S. Nat. Mus.).

4, 5, 6. *Spilogale putorius* (Linn.). ♂, Greensboro, Alabama (No. 33846, U. S. Nat. Mus.).

7, 8, 9. *Spilogale indianola* Merr. ♂, Elliot's, Matagorda County, Texas (No. 44244, U. S. Nat. Mus.).



SKULLS OF SPILOGALE.

1, 2, 3, Spilogale ambarvalis; 4, 5, 6, Spilogale putorius; 7, 8, 9, Spilogale indianola.

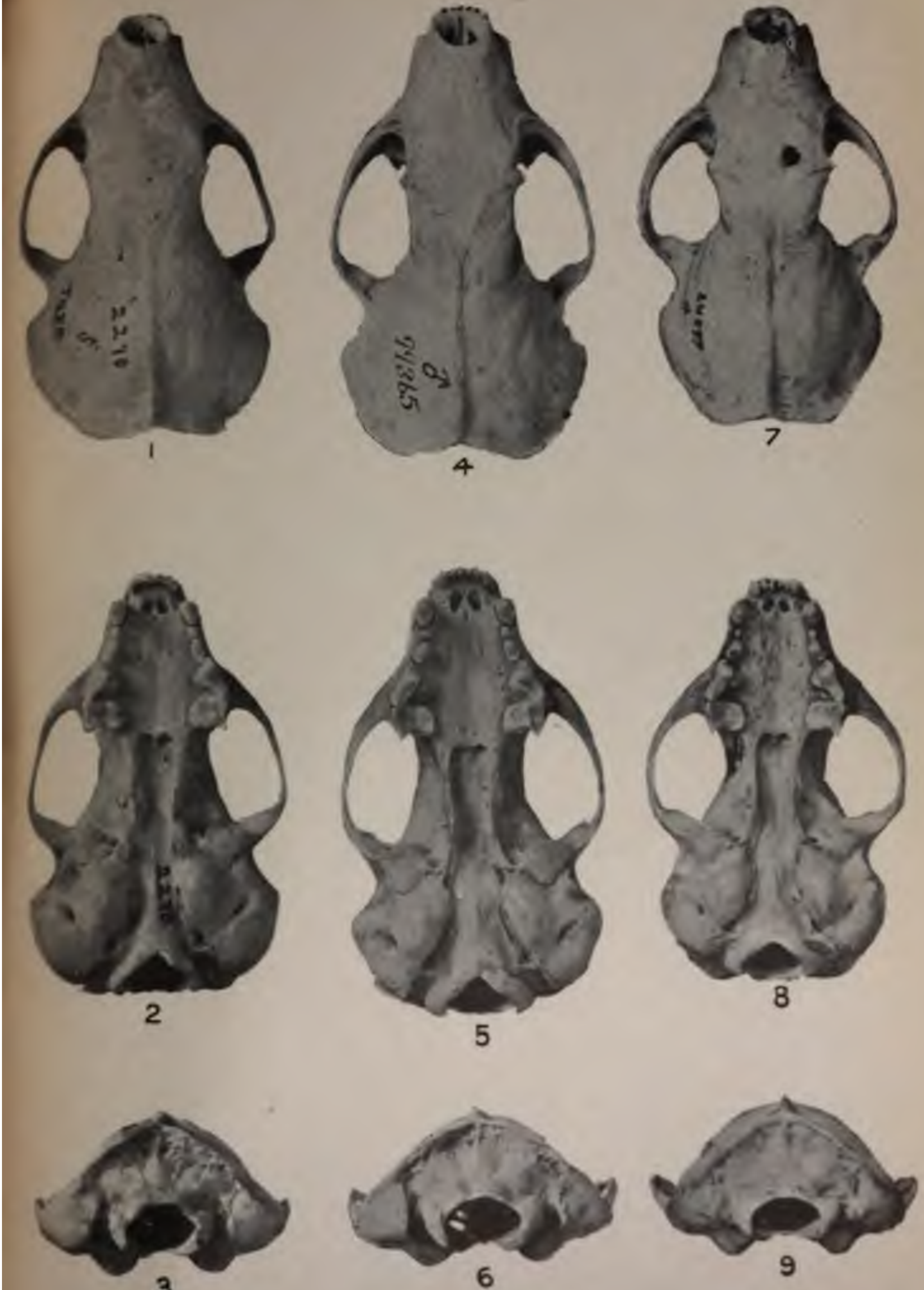
PLATE VI.

(Natural size.)

FIGS. 1, 2, 3. *Spilogale leucoparia* Merr. ♂, type; Mason, Texas (No. 2270, Merriam collection).

4, 5, 6. *Spilogale tenuis* Howell. ♂, type; Arkins, Colorado (No. 99365, U. S. Nat. Mus.).

7, 8, 9. *Spilogale gracilis* Merr. ♂, type; Grand Canyon, Arizona (No. 24897, U. S. Nat. Mus.).



SKULLS OF SPILOGALE.

1, 2, 3, Spilogale leucoparia; 4, 5, 6, Spilogale tenuis; 7, 8, 9, Spilogale gracilis.

PLATE VII.

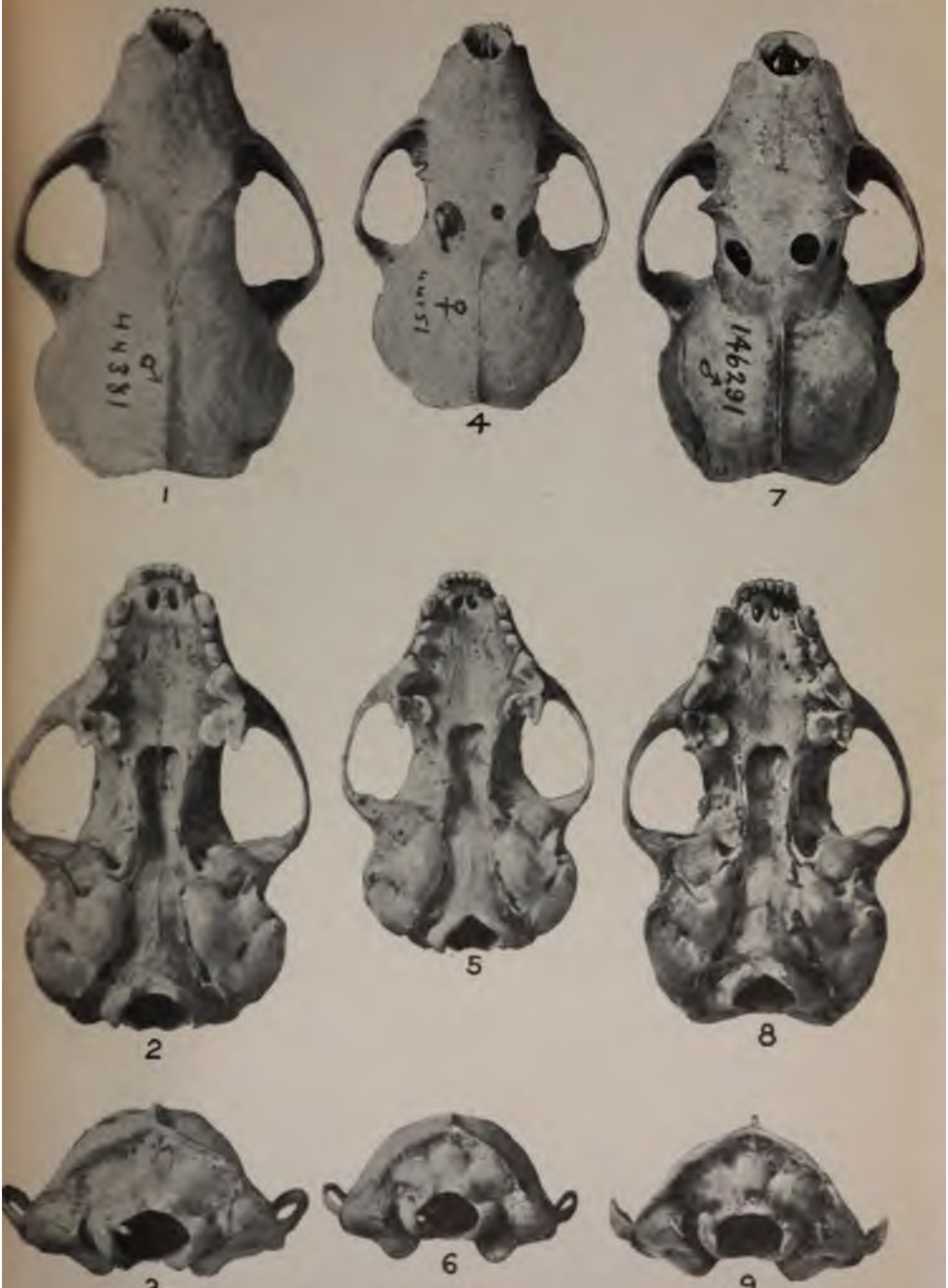
(Natural size.)

FIGS. 1, 2, 3. *Spilogale phenax* Merr. ♂, Fairfield, California (No. 44381, U. S. Nat. Mus.).

4, 5, 6. *Spilogale phenax* Merr. ♀, Glen Ellen, California (No. 44151, U. S. Nat. Mus.).

7, 8, 9. *Spilogale phenax latifrons* Merr. ♂, Hermann, Lane County, Oregon (No. 146291, U. S. Nat. Mus.).

PLATE VII.



SKULLS OF SPILOGALE.

1-6, Spilogale phenax; 7, 8, 9, Spilogale phenax latifrons.

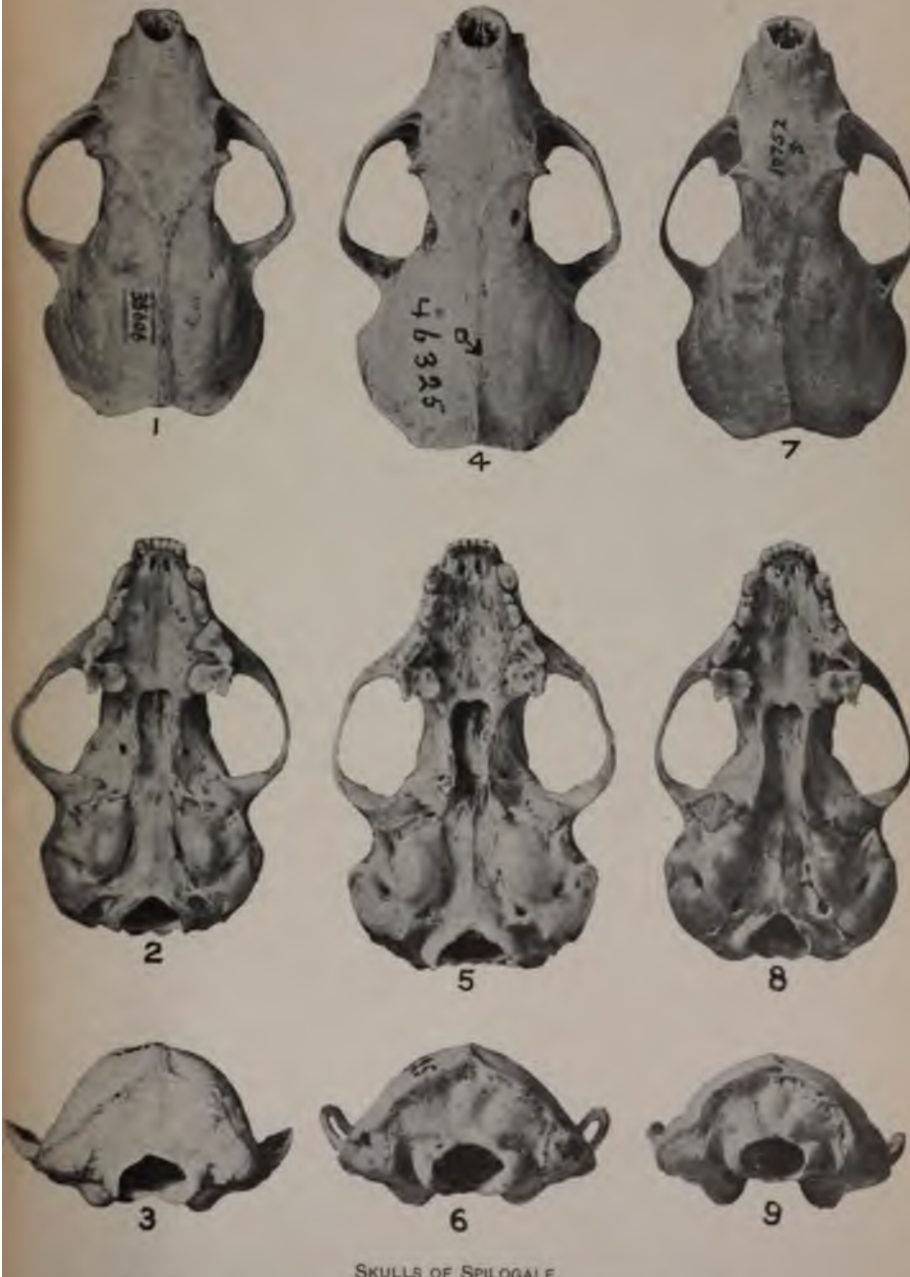
PLATE VIII.

(Natural size.)

FIGS. 1, 2, 3. *Spilogale ambigua* Mearns. ♂, type; Eagle Mountain, Chihuahua (No. 35606, U. S. Nat. Mus.).

4, 5, 6. *Spilogale arizonæ* Mearns. ♂: Fort Huachuca, Arizona (No. 46325, U. S. Nat. Mus.).

7, 8, 9. *Spilogale arizonæ martirensis* Elliot. ♂, type; San Pedro Martir Mountains, Lower California (No. 10752, Field Museum Nat. Hist.).



SKULLS OF SPILOGALE.

1, 2, 3, Spilogale ambigua; 4, 5, 6, Spilogale arizonæ; 7, 8, 9, Spilogale a. martirensis.

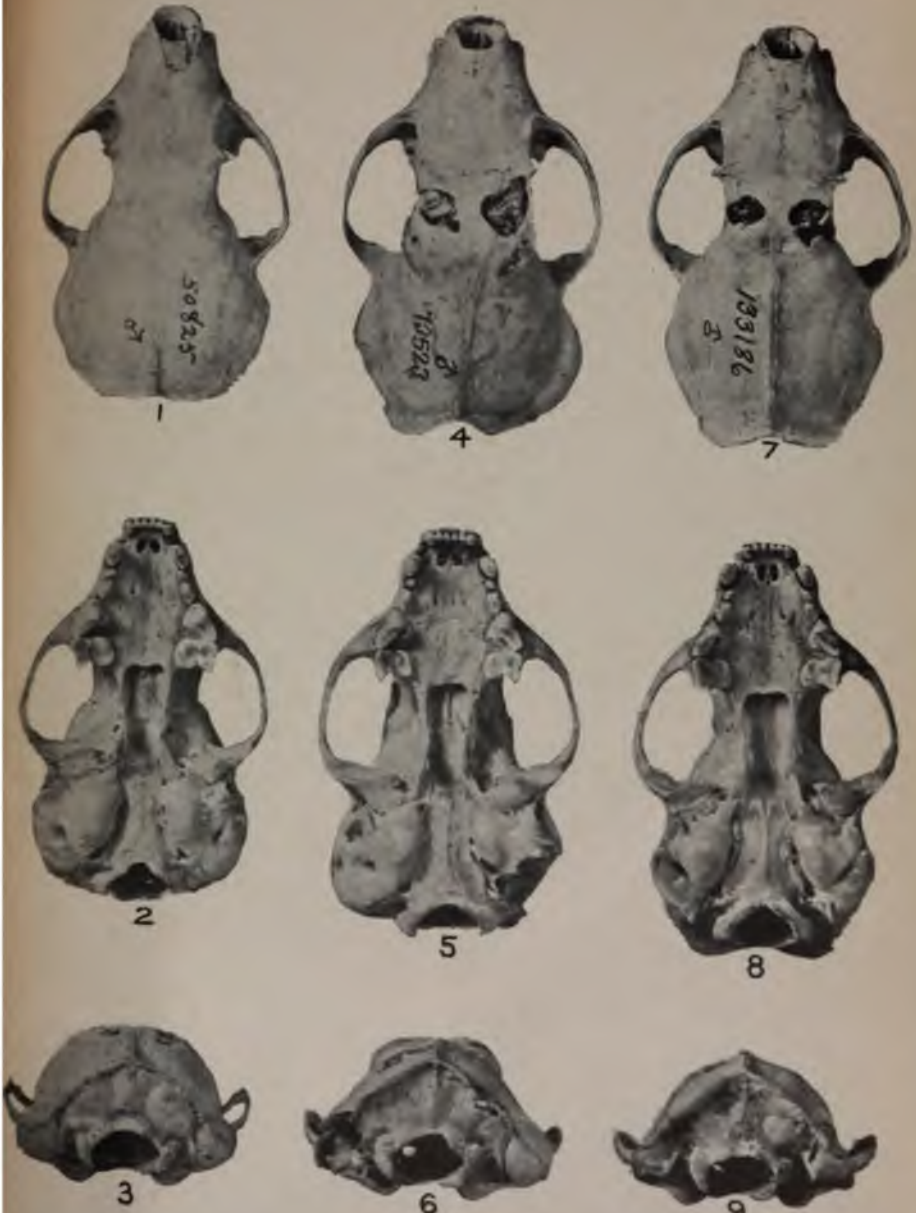
PLATE IX.

(Natural size.)

FIGS. 1, 2, 3. *Spilogale angustifrons* Howell. ♂, type; Tlalpam, Federal District, Mexico (No. 50825, U. S. Nat. Mus.).

4, 5, 6. *Spilogale angustifrons tropicalis* Howell. ♂, type; San Mateo del Mar, Oaxaca (No. 73523, U. S. Nat. Mus.).

7, 8, 9. *Spilogale angustifrons elata* Howell. ♂, type; San Bartolomé, Chiapas (No. 133186, U. S. Nat. Mus.).



SKULLS OF SPILOGALE.

1, 2, 3, Spilogale angustifrons; 4, 5, 6, Spilogale a. tropicalis; 7, 8, 9, Spilogale a. elata.

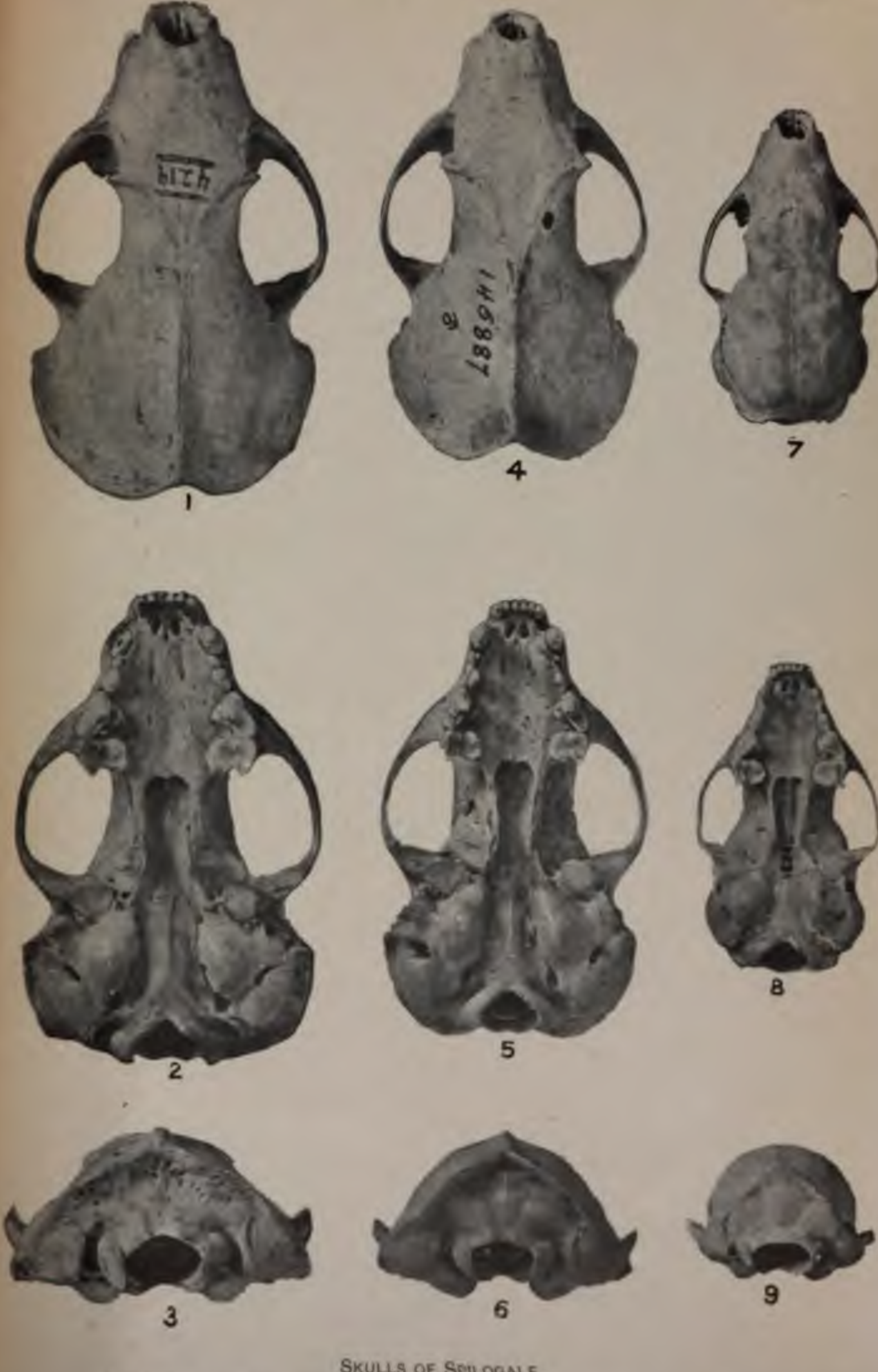
PLATE X.

(Natural size.)

Figs. 1, 2, 3. *Spilogale lucasana* Merr. ♂, type; Cape St. Lucas, Lower California (No. 4219, U. S. Nat. Mus.).

4, 5, 6. *Spilogale microdon* Howell. ♂, type; Comondú, Lower California (No. 145887, U. S. Nat. Mus.).

7, 8, 9. *Spilogale pygmaea* Thomas. ♂; Acapulco, Guerrero (No. 70581, U. S. Nat. Mus.).



SKULLS OF SPILOGALE.

1, 2, 3, Spilogale lucasana: 4, 5, 6, Spilogale microdon., 7, 8, 9, Spilogale pygmaea.

PLATE X.

(Natural size.)

FIGS. 1, 2, 3. *Spilogale lucasana* Merr. ♂, type; Cape St. Lucas, Lower California (No. 4219, U. S. Nat. Mus.).

4, 5, 6. *Spilogale microdon* Howell. ♂, type; Comondú, Lower California (No. 145887, U. S. Nat. Mus.).

7, 8, 9. *Spilogale pygmæa* Thomas. ♂; Acapulco, Guerrero (No. 70581, U. S. Nat. Mus.).

INDEX.

[Names of new species in **black face type**. Synonyms in *italics*.]

- *Mephitis bicolor*, 6, 11, 14, 31.
  - *interrupta*, 6, 18.
  - *putorius*, 14.
  - *quaterlinearis*, 11, 18.
  - *zorilla*, 31.
- *Mustela putida*, 11.
- Skunk, spotted, Alleghenian, 15-18.
  - Arizona, 29-30.
  - California, 31-32.
  - canyon, 22-23.
  - Cape St. Lucas, 34-35
  - Chihuahua, 24-25.
  - Florida, 14-15.
  - Great Basin, 23-24.
  - Gulf, 19-20.
  - highland, 27.
  - Oregon, 32-33.
  - Peninsula, 30-31.
  - pigmy, 28-29.
  - prairie, 18-19.
  - Puget Sound, 33-34.
  - Rio Grande, 20-21.
  - Rocky Mountain, 21-22.
  - small-toothed, 34.
  - table-land, 26.
  - tropical, 26-27.
- Spilogale, characters, external, 9-10.
  - characters, generic, 12.
  - cranial measurements, 36-37.
  - distribution, 7.
  - food, 8-9.
  - habits, 7-8.
  - history, 5-7.
  - hydrophobia, 8.
  - genus, 12.
- Spilogale, key to species, 12-13.
  - list of species, 13.
  - material examined, 5-7.
  - new species, 34-35.
    - descriptions of, 27, 34.
  - nomenclature, 10-11.
    - generic names, 10.
    - specific names, 11-12.
  - type localities, 13.
- Spilogale ambarvalis, 13, 14-15.
  - ambigua, 13, 24-25.
  - angustifrons, 13, 26.
  - arizonæ, 13, 29-30.
  - **elata**, 6, 13, 27-28.
  - gracilis, 13, 22-23.
  - indianola, 13, 19-20.
  - interrupta, 13, 18-19.
  - latifrons, 13, 32-33.
  - leucoparia, 13, 20-21.
  - lucasana, 7, 13, 34-35.
  - martirensis, 13, 30-31.
  - **microdon**, 6, 13, 34.
  - olympica, 13, 33-34.
  - phenax, 7, 13, 31-32.
  - putorius, 13, 15-18.
  - pygmæa, 13, 28-29.
  - *ringens*, 11, 15.
  - saxatilis, 13, 23-24.
  - tenuis, 7, 13, 21-22.
  - tropicalis, 7, 13, 26-27.
- *Viverra mapurita*, 11.
  - *mephitis*, 10, 11.
  - *putorius*, 5, 10, 15.
  - *striata*, 11, 15.
  - *zorilla*, 5, 11-12.

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